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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966.

SPECIAL NOTICES

Effective with this issue of *Scientific and Technical Aerospace Reports (STAR)* the Personal Author Index has been simplified by omitting the titles of indexed reports as subentries under the authors' names. Accession numbers and categories in which the report citations appear will continue to be included in the author index entries. This action has been taken as an essential economy and in recognition of the rarity of more than one report by a given author in an issue. No change will be made in the *STAR* Semiannual and Annual Cumulative Indexes, which will continue to provide the titles of all reports indexed to each author entry.

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INTRODUCTION

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set.

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. 1142

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. 1147

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Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. 1157

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Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. **1230**

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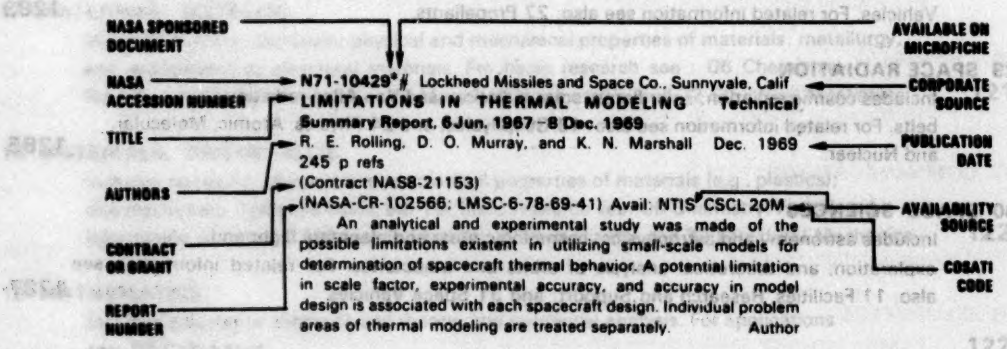
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LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 8 Dec. 1969
AUTHORS
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
PUBLICATION DATE
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

VOLUME 9 NUMBER 8 / APRIL 23, 1971

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-18397*# Techtran Corp., Glen Burnie, Md.
MEASUREMENTS OF INTERFERING UNSTEADY FORCES BETWEEN LIFTING SURFACES IN TANDEM [MESURES DES FORCES INSTATIONNAIRES D'INTERACTION ENTRE SURFACES PORTANTES EN TANDEM]
R. Destuynder Washington NASA Feb. 1971 18 p refs Transl. into ENGLISH from French Report ONERA-TP-890
(Contract NASw-2037)
(NASA-TT-F-13482; ONERA-TP-890) Avail: NTIS CSCL 01A

Wind tunnel tests were conducted in order to determine the effect of interference between two lifting surfaces in tandem. Models of rectangular and swept wings were used with variable horizontal and vertical separations. The tests were limited to pure pitch and translation of the wings. Author

N71-18423# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
DELTA WING STUDY IN A LOW DENSITY HYPERSONIC FLOW [ETUDE D'UN ECOULEMENT HYPERSONIQUE A BASSE DENSITE AUTOUR D'AILES DELTA]
Jean Allegre and Jean-Claude Festinger Sep. 1970 59 p refs In FRENCH; ENGLISH summary
(Rept-70-9) Avail: NTIS

Experiments are performed in a rarefied hypersonic flow characterized by a Mach number of 8 and a free stream Reynolds number of 2200 per cm. Present results include wall pressure and heat transfer distributions along 60 and 70 deg delta wings, considering both incidence and leading edge thickness effects. Wall pressure and heat transfer data on the wing axis are compared with previous theoretical laws valid in the strong interaction regime. Drag and lift coefficients are deduced from aerodynamic force measurements. In order to point out the skin friction effect, aerodynamic force components due only to the wall pressure are calculated and compared with total aerodynamic force values. Author (ESRO)

N71-18424# Cambridge Univ. (England). Dept. of Engineering.
IMPROVED ENTRAINMENT METHOD FOR CALCULATING TURBULENT BOUNDARY LAYER DEVELOPMENT
M. R. Head and V. C. Patel London Aeron. Res. Council Mar. 1968 27 p refs Supersedes ARC-31043
(ARC-R/M-3643; ARC-31043) Copyright. Avail: NTIS; HMSO: 70p; BIS: $2.80
(ARC-R/M-3643; ARC-31043)

A simple integral method is presented for the calculation of two dimensional incompressible turbulent boundary layers. Use is made of established relationships to determine values of the entrainment coefficient for equilibrium layers, and the entrainment coefficient for nonequilibrium conditions is obtained by multiplying the corresponding equilibrium value by a suitable empirical function. This increases the entrainment when the rate of growth of the layer is less than that of the corresponding equilibrium layer, and decreases it when the rate of growth is greater. This variation of entrainment is in accordance with observation, and a simple physical explanation is proposed to account for it. This explanation further suggests how the effects of flow convergence may be taken into account. Comparisons with measured boundary layer developments show the general accuracy of the method. Author (ESRO)

N71-18425# National Physical Lab., Teddington (England). Aerodynamics Div.
NUMERICAL APPRAISAL OF MULTHOPP'S LOW-FREQUENCY SUBSONIC LIFTING-SURFACE THEORY
H. C. Garner London Aeron. Res. Council 1970 102 p refs Supersedes NPL-AERO-1278; ARC-30607; N69-38133
(ARC-R/M-3634; NPL-AERO-1278; ARC-30607) Copyright. Avail: NTIS; HMSO: £2.60; BIS: $9.36

Extensive tabulated results are presented for 17 varied planforms at uniform incidence or in low-frequency pitching oscillation. Numerical accuracy and convergence are studied in relation to parameters representing chordwise and spanwise collocation, spanwise integration, and central rounding of sweptback wings; general criteria for selecting these are recommended. Collocation error is reduced by doubling the central rounding, but no improvement is obtained unless its aerodynamic influence is subtracted. Author (ESRO)

N71-18439# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
WING LIFTING LINE REPRESENTATION: APPLICATION TO THE TWO WINGS IN TANDEM INTERACTION [REPRESENTATION D'UNE AILE PAR DES LIGNES PORTANTES: APPLICATION AU CALCUL DE L'INTERACTION DE DEUX AILES EN TANDEM]
Roland Dat and Yoshio Akamatsu 1970 18 p refs In FRENCH; ENGLISH summary Presented at the AGARD Symp. on Unsteady Aerodyn. for Aeroelastic Anal. of Interfering Surfaces, Toensberg, Norway, 3 – 4 Nov. 1970 Submitted for publication
(ONERA-TP-891; Rept-5) Avail: NTIS

The simulation of wings by a lattice of lifting lines appears to be suitable for the computation of unsteady aerodynamic forces on combinations including several lifting surfaces, such as wing-horizontal tail or fin-horizontal tail. It can be considered as a compromise between the doublet lattice method, which is advantageous for its flexibility, and the so-called lifting surface method, the results of which are more accurate for a given number of collocation points. A numerical program has been developed for the application to wings in two parallel planes. The particular features of the calculation method are presented, as well as some numerical results. Author (ESRO)

N71-18441# Aviatest GmbH, Duesseldorf (West Germany).
INVESTIGATIONS OF HYPERSONIC CHARACTERISTICS OF TWO PHASE FLOWS AND THEIR POSSIBLE USE FOR AERODYNAMIC MEASUREMENTS [UNTERSUCHUNGEN ZUM UEBERSCHALLVERHALTEN VON ZWEIPHASENSTROEMUNGEN UND IHRER MOEGLICHEN ANWENDUNG FUER AERODYNAMISCHE MESSUNGEN]
V. Denk, B. Feldmann, and H. Griesser Bonn Bundeswehramt 1970 147 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVtdg-FBWT-70-1) Avail: NTIS; Bundeswehramt, Bonn: 25 DM

The pilot plant for generation of quasi-homogeneous water-air-mixture flows is described. Emphasis is made on the measurement of the two phase flow characteristics and various measurement methods are dealt with. The tests performed confirm the theoretically expected supersonic characteristics of the two phase flow at slight flow rates, and show the possibility to apply the test results to aerodynamics. Author (ESRO)

N71-18444# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Abteilung Ueberschallkanal.
EFFECT OF THE POSITION OF MAXIMUM THICKNESS AND OF THE LENGTH OF BODIES OF REVOLUTION ON AERODYNAMIC COEFFICIENTS IN SUPERSONIC FLOW [EINFLUSS DER DICKENRUECKLAGE UND DER RUMPFLAENGE VON ACHSENSYMMETRISCHEN FLUGKOERPERN AUF DIE AERODYNAMISCHEN BEIWERTE IM UEBERSCHALL]
Hansgeorg Riedel, Hans Emunds, and Franz Joachim Niezgodka Nov. 1970 190 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-54) Avail: NTIS; ZLDI Munich: 66,60 DM

The aerodynamic coefficients of bodies of revolution consisting of ogive-cylinder combinations were determined in a 30 x 30 sq cm supersonic wind tunnel by force and pressure measurements for the Mach number range from 1.57 to 4.15. A comparison is made of the results with the slender body theory and a first and second order theory. Author (ESRO)

N71-18449# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MEASUREMENT OF UNSTEADY AIR LOADS OF INTERACTING LIFTING SURFACES IN TANDEM [MESURES DES FORCES INSTATIONNAIRES D'INTERACTION ENTRE SURFACES PORTANTES EN TANDEM]
Roger Destuynder 1970 13 p refs In FRENCH; ENGLISH summary Presented at the AGARD Symp. on Unsteady Aerodyn. for Aeroelastic Anal. of Interfering Surfaces, Toensberg, Norway, 3–4 Nov. 1970 Submitted for publication
(ONERA-TP-890) Avail: NTIS

Wind tunnel tests have been performed for analyzing the influence of several parameters on the aerodynamic interference between two lifting surfaces in tandem. The aim was to determine the magnitude of the coupling terms in order to provide a theoretical explanation of the flutter instabilities occurring on variable sweep airplanes. The tests have been limited to two types of motion: pure translation and pure pitching oscillation of one wing. The model consisted of two rectangular or swept wings whose relative position could be adjusted continuously in the horizontal and in the vertical direction. Several conclusions can be drawn from the test results, and the phenomena of interaction are shown to be important for certain configurations. Some comparisons between theory and experiment have been undertaken. Author (ESRO)

N71-18456# National Physical Lab., Teddington (England). Aerodynamics Div.
WAKE BLOCKAGE CORRECTIONS IN A CLOSED WIND TUNNEL FOR ONE OR TWO WALL-MOUNTED MODELS SUBJECT TO SEPARATED FLOW
R. W. F. Gould London Aeron. Res. Council Feb. 1969 23 p refs Supersedes NPL-AERO-1290; ARC-31007
(ARC-R/M-3649; NPL-AERO-1290; ARC-31007) Copyright. Avail: NTIS; HMSO: 60p; BIS: $2.40

Measurements described show that wake blockage corrections apply to rectangular plates normal to the flow, over the aspect ratio range from 1/3 to 3 tested, whether the plates are mounted on the tunnel axis or adjacent to a wall. Only small nonlinear effects were found even when the corrections approached 100%. Blockage correction formulas are developed for use when two models are present in the working section at the same time (but each outside the wake of the other). The method of determining the required blockage factors is described with examples from measurements on flat plates mounted normal to a wall and on lattice models. Author (ESRO)

N71-18461# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
WIND-TUNNEL INVESTIGATIONS OF INSTABILITY IN A CABLE-TOWED BODY SYSTEM
A. R. Mettam London Aeron. Res. Council Feb. 1969 23 p refs Supersedes RAE-TR-69022; ARC-31372
(ARC-R/M-3644; RAE-TR-69022; ARC-31372) Copyright. Avail: NTIS; HMSO: 80p; BIS: $3.20

A brief investigation was made into instability of a body towed by a helicopter. This was undertaken after an incident in which a divergent oscillation led to cable failure in flight. Stability boundaries in terms of cable length and forward speed were determined for the original cable/body system. The effects of various body and suspension modifications were then studied. Existing theory was compared with the experimental results and both were used in forecasting the behavior of a new cable/body system. Subsequent experimental work elsewhere confirmed the validity of these estimates. Enhanced stability of the system was observed at short cable lengths and a possible explanation is suggested. Author (ESRO)

N71-18462# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMPUTATION OF THE AERODYNAMIC INTERACTIONS BETWEEN AIRCRAFT LIFTING ELEMENTS IN SUPERSONIC STEADY OR UNSTEADY FLOW [CALCUL D'INTERACTIONS AERODYNAMIQUES ENTRE LES ELEMENTS PORTANTS D'UN AVION EN ECOULEMENT SUPERSONIQUE STATIONNAIRE OU INSTATIONNAIRE]
Michel Enselme, Jean-Paul Boisseau, and Andre Guillois 1970 8 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Aerodyn. Interference, Silver Spring, MD., 28–30 Sep. 1970 Submitted for publication
(ONERA-TP-850) Avail: NTIS

After recalling the principle of analog computation of a lifting assembly in supersonic steady or unsteady flow a numerical process copied on the analog process using an explicit method for computing the solutions of the wave equation is presented.

Results obtained either by analog or by numerical computation are presented. They concern wing-body or wing-pod interactions, and the computation of a wing of arbitrary planform in unsteady flow.
Author (ESRO)

N71-18464# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
WIND TUNNEL INVESTIGATION INTO AERODYNAMIC INTERACTIONS INDUCED BY DROP LOADS [ETUDE EN SOUFFLERIE DES INTERACTIONS AERODYNAMIQUES DUES AUX CHARGES LARGABLES]
Jean Christophe and Jacques Coste 1970 13 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Aerodyn. Interference, Silver Spring, MD., 28–30 Sep. 1970 Submitted for publication
(ONERA-TP-849) Avail: NTIS

The wind tunnel techniques currently used for the investigation into aerodynamic interactions induced by drop loads are reviewed and some representative results shown. Special attention is paid to directly tracing the trajectories of dropped loads and microrocket-propelled missiles by high-speed filming in the tunnel. The results so obtained are compared with those of the newly developed alternative method of weighing the load in the aerodynamic field of the aircraft and reconstructing its trajectory by a computing routine.
Author (ESRO)

N71-18468# Cambridge Univ. (England). Dept. of Engineering.
CALCULATION OF THE TURBULENT BOUNDARY LAYER IN A VORTEX DIFFUSER
T.-S. Cham and M. R. Head London Aeron. Res. Council May 1969 32 p refs Supersedes ARC-31237
(ARC-R/M-3646; ARC-31237) Copyright. Avail: NTIS; HMSO: 80p; BIS: $3.20

In two dimensional potential flow the combination of a source and free vortex produces an axisymmetric flow with streamlines in the form of equiangular spirals. Calculations have been made of the turbulent boundary layer developing beneath such a flow and the results have been compared with measurements made elsewhere. The integral equations of momentum and entrainment are satisfied in a streamline coordinate system in the calculation method used.
Author (ESRO)

N71-18469# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
CALCULATION OF THE POTENTIAL FLOW AROUND ROTATIONALLY SYMMETRICAL RING PROFILES [BERECHNUNG DER POTENTIALSTROEMUNG UM ROTATIONSSYMMETRISCHE RINGPROFILE]
W. Geissler 1970 120 p refs In GERMAN *Its* Mitt. aus dem Max-Planck-Inst. fuer Stroemungsforsch. und Aerodyn. Versuchsanstalt No. 47
Avail: NTIS

A procedure is shown for calculating the potential flow around rotationally symmetrical ring profiles using the singularity method. Contrary to linearized methods, utilizing singularity distributions on a cylindrical substitute body, this procedure uses vortex distributions on the curved profile surface. Main problems of profile theory for ring profile skeletons and thick ring profiles are solved.
ESRO

N71-18472# Max-Planck-Institut fur Stromungsforschung, Gottingen (West Germany).
PECULIARITIES OF TURBULENT WAKES [EIGENTUEMLICHKEITEN TURBULENTER NACHLAUFSTROEMUNGEN]
R. Ermshaus 1970 94 p refs In GERMAN *Its* Mitt. aus dem Max-Planck-Inst. fuer Stroemungsforsch. und Aerodyn. Versuchsanstalt No. 46
Avail: NTIS

Mean and turbulent parameters of plane and rotationally symmetrical wakes were investigated in a wind tunnel. The results show distinct differences in the profiles of their wakes. For both types of wake a uniform exponent of width development was found.
ESRO

N71-18473# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF LIFTING SURFACE THEORY TO WINGS WITH CONTROL SURFACES [APPLICATION DE LA THEORIE DE LA SURFACE PORTANTE A DES AILES MUNIES DE GOUVERNES]
Bertrand Darras and Roland Dat 1970 15 p refs In FRENCH; ENGLISH summary Presented at the AGARD Symp. on Unsteady Aerodyn. for Aeroelastic Anal. of Interfering Surfaces, Toensberg, Norway, 3–4 Nov. 1970 Submitted for publication
(ONERA-TP-889) Avail: NTIS

The problem of control surfaces in subsonic unsteady flow is considered. The method for solving it is based on the formulation of the logarithmic singularity of the pressure field and on an analysis of the usual matrix solution of the integral equation. This method is extended here to an arbitrary planform. The comparison of experimental and theoretical results obtained for the rectangular wing is also shown.
Author (ESRO)

N71-18556# Aerospace Corp., El Segundo, Calif. Lab. Operations.
NEAR-CONTINUUM AXISYMMETRIC HYPERSONIC FLOW PAST VERY SLENDER BODIES, OCTOBER 1969–JULY 1970
John W. Ellinwood 30 Oct. 1970 45 p refs
(Contract F04701-70-C-0059)
(AD-715901; TR-0059-6240-10-2; SAMSO-TR-70-409) Avail: NTIS CSCL 20/4

The hypersonic theory for boundary layers with large transverse curvature is relaxed to allow surface slip and jump. Slip and jump coefficients for use with this continuum theory are found to be essentially unaffected by transverse curvature of the Knudsen layer. This finding follows from a study of the linearized model equation including transverse curvature terms, with diffuse reflection and total accommodation assumed at the surface. When used to estimate skin friction on an insulated 5-deg half-angle cone in helium at Mach 29, the present theory proved to be both sufficient and useful over most of the transitional flow regime. The slip velocity ratio us is two and a half times as large as Mach number over root Reynolds number, which measures other neglected near-continuum effects.
Author (GRA)

N71-18558*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF A LARGE-SCALE V/STOL TRANSPORT MODEL WITH TANDEM LIFT FANS MOUNTED AT MID-SEMISPAN OF THE WING
Stanley O. Dickinson, Leo P. Hall, and Brent K. Hodder Washington Mar. 1971 64 p refs
(NASA-TN-D-6234; A-3189) Avail: NTIS CSCL 01C

The low-speed aerodynamic characteristics of a large-scale V/STOL transport model powered by tip-turbine-driven fans were investigated. The model has four fans, tandem mounted in pods, fore and aft of the wing at mid-semispan. The high mounted wing had an aspect ratio of 5.8, was swept back 35 deg at the quarter-chord line, and had a taper ratio of 0.3. The results showed a large increase in lift with forward speed in spite of the unloading of the wing induced by front fan operation. Longitudinal characteristics with four fans operating appear to be similar to the characteristics of conventional aircraft. A comparison of test results,

past and present, indicates that a configuration with the front fans at wing mid-semispan and the aft fans inboard near the wing root may have good induced lift characteristics. Author

N71-18749*# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.

SINGLE STAGE EXPERIMENTAL EVALUATION OF BOUNDARY LAYER BLOWING AND BLEED TECHNIQUES FOR HIGH LIFT STATOR BLADES, 5 Final Report

R. J. Loughery, R. A. Horn, Jr., and P. C. Tramm Mar. 1971 106 p refs

(Contracts NAS3-7619; NAS3-7900)

(NASA-CR-54573; EDR-6060) Avail: NTIS CSCL 01A

Tests were conducted on a single-stage compressor rig to determine the feasibility of increasing stator blade loading beyond current levels by bleeding or blowing the suction surface boundary layer. The compressor rig employed stator hub and tip end wall boundary layer bleeds. Six highly loaded stator configurations were tested. One of the configurations employed no suction surface boundary layer bleeding or blowing features and was used to establish a performance base line. Two stator configurations provided for suction surface boundary layer bleed and the other three stator configurations employed features to reenergize the suction surface boundary layer by blowing. A significant improvement in stator performance was achieved with suction surface boundary layer bleed compared to the baseline configuration. Performance with suction surface boundary layer blowing was generally inferior to that of the baseline configuration. Author

N71-18838 Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.

AN EVALUATION OF THE USEFULNESS OF FOUR SECONDARY TASKS IN ASSESSING THE EFFECT OF A LAG IN SIMULATED AIRCRAFT DYNAMICS

H. F. Huddleston and R. V. Wilson Jul. 1969 18 p refs

(IAM-R-479) Copyright. Avail: Issuing Activity

Eight male subjects were required to perform a tracking task using an electronic windshield display. The task had two levels of difficulty, an essentially unlagged condition and a condition, chosen to be perceptibly more difficult, having an exponential lag of 0.5 sec. Integrated tracking error scores alone were unable to distinguish between the two difficulty levels. Four secondary tasks were utilized involving a response to digits presented in the forward field of view. These four tasks were arranged to be of comparable difficulty level in pretests using the same subjects. Two secondary tasks indicated a difference between the primary task conditions. The addition of a secondary task also permitted tracking error scores themselves to indicate a difference. Author

N71-18867*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

LIFT AND DRAG CHARACTERISTICS OF THE HL-10 LIFTING BODY DURING SUBSONIC GLIDING FLIGHT

Jon S. Pyle Washington Mar. 1971 26 p refs

(NASA-TN-D-6263) Avail: NTIS CSCL 01C

Subsonic lift and drag data obtained during the HL-10 lifting body glide flight program are presented for four configurations for angles of attack from 5 deg to 26 deg Mach numbers from 0.35 to 0.62. These flight data, where applicable, are compared with results from small-scale wind-tunnel tests of an HL-10 model, full-scale wind-tunnel results obtained with the flight vehicle, and flight results for the M2-F2 lifting body. The lift and drag characteristics obtained from the HL-10 flight results showed that a severe flow problem existed on the upper surface of the vehicle during the first flight test. This problem was corrected by modifying the leading edges of the tip fins. The vehicle attained lift-drag ratios as high as 4.0 during the landing flare (performed with the landing gear up), which is approximately 14 percent higher than demonstrated by the M2-F2 vehicle in similar maneuvers. Author

N71-18987*# Translation Consultants, Ltd., Arlington, Va.

A NUMERICAL METHOD OF DETERMINING THE AERODYNAMIC COEFFICIENTS OF THIN SUPERSONIC WINGS WHICH ARE DEPENDENT ON THE ANGLE OF ATTACK [NUMERISCHES VERFAHREN ZUR BESTIMMUNG ANSTELLWINKELABHAENGIGER AERODYNAMISCHER BEIWERTE DUENNER UEBERSCHALLFLUEGEL]

W. H. Diesinger Washington NASA Feb. 1971 62 p refs Transl. into ENGLISH from German report DLR-FB-71-01

(Contract NASw-2038)

(NASA-TT-F-13521) Avail: NTIS CSCL 01A

The numerical method makes use of the linearized potential flow theory and is limited to wings where Evvards theorem can be applied. The method is especially suited for preliminary design calculations where the effects of warping and the wing thickness are not needed. The aerodynamic coefficients are determined by numerical integration of the velocity potential for which the numerical accuracy can be determined by simple addition. Because of the comparatively small number of calculations the method may be applied in order to reduce the running time of existing computer programs. For application to desk calculators, tables are given and simple computational examples included. Author

N71-19114# Advisory Group for Aerospace Research and Development, Paris (France).

AGARD BULLETIN: MEETINGS, MEMBERSHIP, PUBLICATIONS, JANUARY 1971

Jan. 1971 61 p refs

(AGARD-Bul-71/1) Avail: NTIS

The schedule of AGARD 1971 technical meetings is presented. The announcement includes these panel activities: aerospace medicine, avionics, electromagnetic propagation, fluid dynamics, guidance and control, propulsion and energetics, structures and materials, and technical information. The membership of the various panels is given, and summaries of the 1970 AGARD publications are included. F.O.S.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-18269# School of Aerospace Medicine, Brooks AFB, Tex.

NOISE ASSOCIATED WITH OPERATION OF THE C-9A (AEROMEDICAL EVACUATION) AIRCRAFT

Donald C. Gasaway Oct. 1970 37 p refs

(AD-715222; SAM-TR-70-63) Avail: NTIS CSCL 20/1

Noise within the Douglas C-9A during various phases of operation is described and illustrated. Near-field acoustic exposures are also discussed and illustrated. Degrees of speech interference and auditory risk are discussed and methods of controlling potentially undesirable effects are proposed. Author (GRA)

N71-18367*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PRELIMINARY STUDY OF ADVANCED HYPERSONIC RESEARCH AIRCRAFT

Le Land H. Jorgensen, Walter P. Nelms, Jr., and Lionel L. Levy, Jr. Washington Mar. 1971 18 p refs

(NASA-TM-X-2222; A-3567) Avail: NTIS CSCL 01C

Important flight constraints for hypersonic research aircraft are reviewed. Maximum lift-drag ratios for state-of-the-art hypersonic aircraft in trimmed flight have been derived from wind-tunnel tests. Weights, cruise times, and ranges for rocket-boosted research airplanes with air-breathing cruise engines are estimated and compared. Both horizontal take-off from the ground and air launch from a subsonic airplane are considered. Author

N71-18422*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

EXPERIENCE WITH THE X-15 ADAPTIVE FLIGHT CONTROL SYSTEM

Washington Mar. 1971 28 p refs

(NASA-TN-D-6208; H-618) Avail: NTIS CSCL 01C

The X-15 adaptive flight control system is briefly described, and system development and flight-test experiences in the X-15 research airplane are reviewed. Airplane handling qualities with the system and system reliability are also discussed. Author

N71-18428*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif.

LIFTING-BODY Progress Report

Milton O. Thompson 1970 4 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7 – 8 Jul. 1970

(NASA-TM-X-68712) Avail: NTIS CSCL 22A

The lifting body flight test program, concerning mainly the HL-10 reentry vehicle, the M2-F2 lifting body, and the X-24A aircraft is described. The flight test results demonstrate that configurations designed for lifting entry can have acceptable low speed flight characteristics and adequate maneuverability for approach and landing and are suitable for the shuttle mission. ESRO

N71-18442*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

FLIGHT EVALUATION OF ANGLE OF ATTACK AS A CONTROL PARAMETER IN GENERAL-AVIATION AIRCRAFT

Shu W. Gee, Harold G. Gaidsick, and Einar K. Enevoldson Washington Mar. 1971 23 p refs

(NASA-TN-D-6210; H-603) Avail: NTIS CSCL 01C

The use of angle-of-attack information for a pilot's display in a general-aviation airplane was investigated to determine whether this form of information would improve performance and flight safety. An angle-of-attack system consisting of a wing-mounted vane, an electronic computer unit, and a display instrument was installed and flight tested in a typical twin-engine, general-aviation airplane. The flight-test maneuvers were limited to the low-speed flight region where the benefits of angle-of-attack presentation were likely to be greatest. Some of the expected advantages of this parameter, such as visual indication of stall margin and its independence of gross weight and flap position, were realized; however, certain aerodynamic characteristics of the airplane, such as the phugoid and directional-control capability, were found to limit and tended to negate some of the expected advantages. As a result, this use of angle of attack did not show a significant improvement in performance and flight safety. Author

N71-18489*# Boeing Co., Seattle, Wash.

STUDY AND DEVELOPMENT OF TURBOFAN NACELLE MODIFICATIONS TO MINIMIZE FAN-COMPRESSOR NOISE RADIATION VOLUME 7: SUBJECTIVE EVALUATION TESTS Contractor Report, 1 May 1967 – 1 Nov. 1969

Washington NASA Jan. 1971 104 p refs

(Contract NAS1-7129)

(NASA-CR-1717) Avail: NTIS CSCL 01C

Judgments of relative annoyance caused by flyover noises from a standard Boeing 707-3208 and one with acoustically treated nacelles were made by 180 persons. The primary aim of the experiment was to determine whether the noise reductions measured during previous flight tests of the acoustically treated nacelles would be perceived by a sample of persons from the community. This aim was achieved by determining the relationship between the noise ratings of the 180 judges and each of 18 engineering calculation procedures that convert sound pressure spectra into subjective units. Author

N71-18508*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

VERIFICATION OF TAKEOFF PERFORMANCE PREDICTIONS FOR THE XB-70 AIRPLANE

Terry J. Larson and William G. Schweikhard Washington Mar. 1971 29 p refs

(NASA-TM-X-2216; H-574) Avail: NTIS CSCL 01C

XB-70 airplane standardized takeoff data are compared with simple predictions based on aerodynamic and engine estimates. Effects of atmospheric and aircraft variables on takeoff distance are evaluated. Although experimentation with various techniques for aircraft rotation to liftoff attitudes was limited, the effects of the pilot techniques used are discussed and compared. Predictions of distance from brake release to initiation of rotation as a function of velocity were found to be accurate to approximately 100 feet. Because of the significant drag at the high aircraft attitudes required for takeoff, the standardized ground roll distance for a given velocity was increased nominally by 400 feet over the distance which would occur with no increase in drag. Standardized performance during climb from liftoff to a height of 35 feet with all engines operating was marginal because of low longitudinal accelerations, resulting from high induced drag at liftoff attitude. Author

N71-18532# Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).

SERVICE LOADS OCCURRING ON MAIN LANDING GEARS OF F-104G TYPE AIRPLANES [BETRIEBSKRAEFTE AN HAUPTFAHRWERKEN DES FLUGZEUGES F-104G]

O. Buxbaum Fraunhofer Ges. Jan. 1970 104 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung Prepared for Entwicklungsring-Sued

(FB-82-1969) Avail: NTIS

At the main landing gears of two airplanes vertical, lateral, and drag loads have been recorded continuously during 50 flights and have been analyzed statistically. The loading conditions such as landing, springback, taxi, transition, braking, engine run-up, turning, and pivoting; the cumulative frequencies and extreme value distributions of the different loads in the three axes are presented. The correlations between simultaneously occurring load components are also discussed. Author (ESRO)

N71-18550*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FURTHER STUDIES OF THE EXTRAPOLATION OF NEAR FIELD OVERPRESSURE DATA

Joel P. Mendoza and Raymond M. Hicks Washington Mar. 1971 34 p refs

(NASA-TM-X-2219; A-3716) Avail: NTIS CSCL 20D

The technique of extrapolating measured near-field overpressure data to any larger altitude has been applied to wind-tunnel overpressure data for a wide variety of wing-body combinations. A compilation of measured and extrapolated overpressure data is presented here in an effort to show the range of configurations for which the extrapolation technique is applicable. Included are simple shapes, such as cone-cylinder and unswept wing-alone models, as well as complete airplane configurations. The range of test Mach numbers was 1.41 to 3.0, while the altitude to model length ratio varied from 1 to 20. Except for the case of a high aspect ratio wing-alone model, the extrapolation procedure was shown to give

almost perfect agreement with experimental measurement; even for the high aspect ratio wing alone, the agreement was adequate. A method for determining the validity of the extrapolation is discussed. Author

N71-18568*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN ALGORITHM FOR DIGITAL RESOLUTION OF RANGE FOR V/STOL AIRCRAFT

Gilbert G. Robinson and Michael J. Bondi Washington Mar. 1971 22 p refs

(NASA-TN-D-6232; A-2842) Avail: NTIS CSCL 01C

The system described provides the necessary precise range measurements for the trilateration technique used in guiding V/STOL aircraft during all-weather and variable approach operation. In a trilateration scheme, two or three ranges are measured from the aircraft to transponders on the ground. Each range is measured by determining the phase delay of a continuous radio wave transmitted from the aircraft to a ground transponder and back. For precision, three radio waves of different frequencies are transmitted to each transponder to provide a coarse, a fine, and a very fine measurement of range. Thus to obtain the inherent accuracy of the very fine measurement unambiguously, this measurement must be combined properly with the fine and coarse range data. Furthermore, the effect of noise on the range words should be minimized. To achieve maximum accuracy, the system investigated presented the primary range data in digital form. A range resolution algorithm is described that allows three ambiguous digital range words derived from a phase measuring system to be combined into a single range word that is unambiguous up to 32 miles. The word retains the very fine resolution afforded by the most precise of the three range words and eliminates the effect of noise to a high degree. The algorithm is developed theoretically and is mechanized. Examples are given showing typical operation. Measurements of the range to an aircraft making an overhead pass indicate that range can be measured to a precision of at least 1.6 feet under actual flight conditions. Author

N71-18586# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

DETERMINATION OF THE COEFFICIENTS IN MULTIVARIABLE SYSTEMS OF FLIGHT DYNAMICS BY A MODEL WITH AUTOMATIC PARAMETER ADJUSTMENT USING AN ANALOG COMPUTER [BESTIMMUNG DER KOEFFIZIENTEN IN MEHRGROESSENSYSTEMEN DER FLUGMECHANIK DURCH EIN MODELL MIT AUTOMATISCHER PARAMETEREINSTELLUNG AM ANALOGRECHNER]

Ruthard Koehler Jul. 1970 27 p refs In GERMAN; ENGLISH summary

(DLR-FB-70-30) Avail: NTIS ZLDI Munich: 9 DM

A multivariable system described by a system of linear differential equations with constant or slowly varying coefficients can be analyzed by a model with automatic parameter adjustment. For checking the method, the longitudinal motions of an aircraft and a helicopter were simulated and analyzed using an analog computer. The results are discussed. Author (ESRO)

N71-18734# Human Engineering Labs., Aberdeen Proving Ground, Md.

VISUAL DETECTION OF ILLUMINATING SURFACES

Richard T. Maruyama Oct. 1970 74 p refs

(AD-715851; HEL-TM-26-70) Avail: NTIS CSCL 1/3

Determining the requirements of helicopter lighting requires selecting the major factors that contribute to the lighting power of a surface light source. Since the light source must be functional, sky brightness, atmospheric attenuation and other characteristics of light sources such as size, shape and angular velocity must be studied. The report presents a model that looks at each of these variables separately. More investigation is needed in the field of search time to improve the reliability of the model for given background luminances. The necessary light output for an area light source can be determined by methods described; in addition the required boundary range for a surface light source can be computed for almost all conditions. Author (GRA)

N71-18739# Illinois Univ., Urbana. Aviation Research Lab.

THE FREQUENCY-SEPARATED DISPLAY PRINCIPLE, PHASE 2 Annual Summary Report, 1 Apr. 1969 – 31 Oct. 1970

David C. Denny, Steven L. Johnson, and Stanley N. Roscoe Oct. 1970 18 p refs

(Contract N00014-67-A-0305-0014)

(AD-715458; TR-ONR-70-3) Avail: NTIS CSCL 1/4

The report includes: (1) a brief review of the frequency-separated display problem, (2) a summary of the work accomplished during Phase I, (3) work accomplished during Phase II, (4) research plans for Phase III, and (5) personnel involved in the research. Author (GRA)

N71-18865*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.

VARIABILITY OF FLYOVER NOISE MEASURES FOR REPEATED FLIGHTS OF TURBOJET AND PISTON ENGINE TRANSPORT AIRCRAFT

Dwight E. Bishop Washington NASA Mar. 1971 38 p refs

(Contract NAS1-8168)

(NASA-CR-1752) Avail: NTIS CSCL 01C

Various flyover noise measures are reported for noise data recorded at five ground positions located underneath and to the side of the flight path during 20 controlled level flight flyovers of two aircraft, (a four-engine piston airplane and a four-engine turbojet airplane) during one day of flight tests. Noise measures are compared to show the degree of variability among flyover measurements during repeat runs or among measurements made at different positions during the same flyover and to show the degree of correlation between different flyover noise measures. The reported flyover measures range from those derived from simple frequency weighting networks, such as the A- or N-weighted sound levels, to those computed from one-third octave band spectra such as the perceived noise level. Author

N71-18929*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NOISE MEASUREMENT EVALUATION OF TAKEOFF AND APPROACH PROFILES OPTIMIZED FOR NOISE ABATEMENT

H. Rodney Peery and Heinz Erzberger Washington Mar. 1971 29 p refs

(NASA-TN-D-6246; A-3548) Avail: NTIS CSCL 01C

A flight investigation to determine the effective perceived noise level associated with certain takeoff and landing profiles has been conducted. The tests were designed to evaluate noise-optimum takeoff profiles, previously obtained in an analytical study, and to investigate the potential for noise abatement of nonstandard approach procedures. During the takeoff tests, the flaps were set at either 27 deg or 10 deg and the climb airspeeds varied from V sub 2 + 15 to V sub 2 + 50 knots (V sub 2 refers to the takeoff safety speed of the aircraft). Power was reduced to yield either 500 or 750 ft/min rate of climb when the aircraft reached 1500 ft altitude. The assumed noise sensitive ground track extended along the runway centerline from 3.5 to 5.7 nautical miles from the start of the takeoff roll. The average of the noise measurements taken at points along the noise sensitive portion of the ground track was used to compare the various takeoff profiles. The takeoff that produced the least average noise, 90.5 EPNdB, used takeoff flaps of 10 deg and a climb airspeed of V sub 2 + 50 knots to 1500 ft altitude, at which point power was reduced to yield a 750 ft/min rate of climb. The landing profiles were flown

along a 3 deg glide slope at constant flap settings of 50 deg, 27 deg, 10 deg, and 0 deg. The approach speed for each profile was 1.3 V sub S1 + 10 knots (V sub S1 refers to stall speed of the aircraft at the flap setting and gross weight used in the approach). In addition, a decelerating profile with engines at flight idle and 0 deg flaps was flown over a single noise measuring station at an altitude of 1000 ft. Reducing the flap setting from 50 deg to 0 deg on the approach reduced the noise from 110.5 to 106.5 EPNdB along the ground track between 5 and 1 nautical miles from the touchdown. The decelerating overflight with engines at flight idle reduced the noise an additional 12.5 EPNdB compared to the 0 deg flap approach at the same altitude. Author

N71-18937# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE FEASIBILITY AND USE OF ANTI-TORQUE SURFACES IMMERSED IN HELICOPTER ROTOR DOWNWASH
Technical Report, Jan. 1968 – Dec. 1969
Chee Tung, John C. Erickson, Jr., and Frank A. DuWaldt Feb. 1970 59 p refs
(Contract N00014-68-C-0241)
(AD-715438; CAL-BB-2584-S-2) Avail: NTIS CSCL 1/3

An analytical investigation was made of the effectiveness of anti-torque aerodynamic surfaces immersed in helicopter rotor downwash. It is shown that additional vertical tail surface having areas equal to about two percent of the main rotor disk area could provide torque trim for speeds above about 75 ft/sec for representative current vehicles. Author (GRA)

N71-19040# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: MARTIN 404, N464M, 8 STATUTE MILES WEST OF SILVER PLUME, COLORADO, 2 OCTOBER 1970
24 Dec. 1970 56 p refs
(NTSB-AAR-71-4) Avail: NTIS

The circumstances leading to the crash of a transport aircraft which caused 30 fatalities are reported. The probable cause of the accident was the intentional operation of the aircraft over a mountain valley route in an altitude from which the aircraft could neither climb over the obstructing terrain ahead, nor execute a successful course reversal. Significant contributions to the accident were: (1) overloaded condition, (2) lack of flight planning, (3) lack of understanding of the aircraft capabilities and limitations, and (4) supervisory error. Author

N71-19041# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: JETCO AVIATION, INCORPORATED, SHORT BROTHERS AND HARLAND, LIMITED, SKYVAN SERIES 3 (SC-7), N21CK, WASHINGTON NATIONAL AIRPORT, WASHINGTON, D.C., 2 JULY 1970
13 Jan. 1971 20 p refs
(NTSB-AAR-71-6) Avail: NTIS

The circumstances preceding a fatal crash of a cargo aircraft are discussed. The aircraft assumed a steep descent and left turn while approaching the airport and crashed in a small body of water. The accident investigation determined that the cause of the accident was a forward shift of improperly secured cargo. Author

N71-19043# National Transportion Safety Board, Washington, D.C.
REPORT OF PROCEEDINGS OF THE NATIONAL TRANSPORTATION SAFETY BOARD INTO THE MIDAIR COLLISION PROBLEM
12 Nov. 1970 138 p refs Conf. held in Washington, D.C., 4 – 10 Nov. 1970
(NTSB-AAS-70-2) Avail: NTIS

The proceedings and recommendations of a conference concerning the subject of midair collisions are presented. Subjects discussed are: (1) traffic segregation in the terminal area, (2) collision avoidance systems, (3) pilot warning indicators, (4) standardized traffic patterns, (5) flightcrew training program, (6) area navigation, (7) visual detection of aircraft on collision course, and (8) primary radar target enhancement. Author

N71-19217# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE: PROJECT OF DOLPHIN-LIKE DIRIGIBLE DISCUSSED
4 Feb. 1971 17 p Transl. into ENGLISH from Various E. European Publications *Its* Scientific Affairs No. 157
(JPRS-52330) Avail: NTIS

The design and characteristics of a double hulled dirigible are discussed. The airship consists of a symmetric airfoil body with end plates for accomodating the crew and passengers. The gas cells are located in the center section of the airship. Propellers are located fore and aft on the center structure and nuclear propulsion is proposed. The advantages of the dirigible lie in its large cargo capacity, aerodynamic stability, and vertical let down capability. P.N.F.

N71-19239*# Boeing Co., Wichita, Kans.
THE SIMULATION OF A LARGE JET TRANSPORT AIRCRAFT. VOLUME 1: MATHEMATICAL MODEL
C. Rodney Hanke Washington NASA Mar. 1971 59 p
(Contract NAS2-5524)
(NASA-CR-1756) Avail: NTIS CSCL 01C

The mathematical models used in the manned simulation of a jumbo jet transport aircraft are described. Included are the models of the basic airframe, the longitudinal lateral and directional control systems, the high lift system, the propulsion system, and the landing gear system. In addition, the low speed buffet characteristics and atmospheric model are described. Included is a list of necessary tests of the simulation to insure validity of the model, of the computer program, and of the quantitative values. Author

N71-19287* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAFFIC CONTROL SYSTEM AND METHOD Patent
Charles R. Laughlin, Roger C. Hollenbaugh, and Walter K. Allen, inventors (to NASA) Issued 13 Oct. 1970 (Filed 30 Jan. 1968) 22 p Cl. 343-112; Int. Cl. G01s5/14
(NASA-Case-GSC-10087-1; US-Patent-3,534,367; US-Patent-Appl-SN-701679) Avail: US Patent Office CSCL 17G

A system is described in which the position of a vehicle, such as a transoceanic SST, is determined by a computer at a central ground station, supplied to a central air traffic controller, and transmitted to a number of adjacent vehicles in flight via a synchronous satellite. Side tone ranging patterns, as well as the digital and voice signals, are modulated on a carrier transmitted from the central station and received on all of the supersonic transports. Each aircraft communicates with the ground stations via a different frequency multiplexed spectrum. Position is determined in response to variable phase information imposed on the side tones at the aircrafts, with a number of different side tone techniques being employed, and relayed back to the transports. Common to all of the side tone techniques is Doppler compensation for the supersonic transport velocity.
Official Gazette of the U.S. Patent Office

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-18463# Army Electronics Command, Fort Monmouth, N.J.
LOW COST OXYGEN ELECTRODES
James E. Wynn Nov. 1970 35 p refs
(AD-715707; ECOM-3354) Avail: NTIS CSCL 10/3

A series of mixed transition metal oxide catalysts have been studied in order to replace presently used platinum catalysts for the air-oxygen electrode in alkaline electrolyte fuel cells, mechanically rechargeable zinc-air batteries, and primary disposable zinc-air batteries. The catalytic materials are mixed oxides of metals like iron, copper, magnesium, cobalt, and aluminum which are inexpensive (compared to Pt) and yet effectively produce initial electrical performance characteristics comparable to the Pt metal catalysts. Author (GRA)

N71-18510*# Electric Storage Battery Co., Yardley, Pa. Exide Missile and Electronics Div.
HEAT STERILIZABLE IMPACT RESISTANT CELL DEVELOPMENT Quarterly Reports, 1 Apr.–30 Sep. 1970
A. M. Chreitzberg Jan. 1971 29 p Prepared for JPL
(Contracts NAS7-100; JPL-951296)
(NASA-CR-116787) Avail: NTIS CSLC 10B

Ten prototype 5.0 AH cells designed for high impact have been developed and evaluated. One cell tested at 4,000 g and an impact velocity of 120 feet per second survived the shock in the terminals aft direction. Seven advanced high cycle life cell designs have each delivered 22-27 AH on initial cycling tests at 100% depth at the 2, 8, and 16 ampere discharge rates. Seventy ampere-hour long life 4-cycle cells have been developed through prototype stages. Reliability life tests were underway at termination of the task to verify optimum techniques for interplanetary travel. Eight prototype 25 AH cells designed to survive shocks of 4000 g from 120 feet per second are under evaluation. Cycle life tests after 72 hours heat sterilization at 135 C have exhibited 72-75 cycles at 50% depth, 2 cycles per day, on a 90 cycle goal. Energy density at the rated C/2 load is 21.5 WH/lb. and 1.6 WH/cubic inch of sealed cell. Author

N71-18511*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
EFFECTS OF LITHIUM DOPING ON THE BEHAVIOR OF SILICON AND SILICON SOLAR CELLS
Paul A. Berman 1 Feb. 1971 26 p refs
(Contract NAS7-100)
(NASA-CR-116793; JPL-TR-32-1514) Avail: NTIS CSCL 10A

The applicability of lithium doping for improvement of silicon solar cell radiation resistance is considered. Results of the industry programs are discussed, in particular the efforts to improve cell processing techniques and the experiments conducted to improve the theoretical understanding of the action of lithium in irradiated silicon and silicon solar cells. The major conclusions reached as a result of the investigations are presented, and suggestions for future work are made. It is concluded that lithium doped solar cells can be fabricated which exhibit (recovered) efficiencies significantly in excess of efficiencies associated with state-of-the-art n/p solar cells after exposure to high fluences of 1-MeV electrons and neutrons. Author

N71-18512*# McDonnel-Douglas Astronautics Co., Richland, Wash.
THERMIONIC ENERGY CONVERSION SYSTEM DESIGN Final Technical Report
J. G. De Steese Jan. 1971 193 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952781)
(NASA-CR-116795; MDC-G2024) Avail: NTIS CSCL 10A

System integrated performance characteristics are calculated for a new family of space power generators each consisting of a multicell array of low temperature, integrally-fueled radioisotope thermionic converters operating in the quasi-vacuum mode. Dominant variables, including the choice and influence of thermionic surface parameters, emitter geometry, fuel form, helium management, array reliability, system integration, and nuclear safety requirements are considered. Parametric study of plutonia fueled multicell generators in the power range from 100 to 200 w sub e shows that system integrated specific power of approximately 4 w sub e/lb and overall conversion efficiencies in excess of 7% are achievable. This performance level is substantiated by a detailed 100 w sub e generator design. Author

N71-18557# Northwestern Univ., Evanston, Ill. Information-Processing and Control Systems Lab.
SURFACE MICROACOUSTICS
Max Epstein Sep. 1970 91 p refs
(Contract N00014-67-A-0356-0003; ARPA Order 1129)
(AD-715674; TR-70-101) Avail: NTIS CSCL 20/1

The report contains an introduction to the field of surface microacoustics. It includes a review of the present state-of-the-art, and an annotated bibliography. Author (GRA)

N71-18563*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
EFFECTS OF HIGH-TEMPERATURE, HIGH-HUMIDITY ENVIRONMENT ON SILICON SOLAR CELL CONTACTS
Robert K. Yasui and Paul A. Berman 15 Feb. 1971 36 p refs
(Contract NAS7-100)
(NASA-CR-116805; JPL-TR-32-1520) Avail: NTIS CSCL 10A

The electrical and mechanical characteristics of various solar cell contact systems after exposure to a high-temperature, high-humidity environment were investigated. An unexpected failure mode involved degradation of the silicon monoxide antireflective coating after environmental exposure. Significant degradation of electrical characteristics was observed in cells having palladium-containing Ti-Ag contacts, and differences in contact structure and composition were noted between different manufacturers. Nonpalladium-containing Ti-Ag contacts on lithium-doped cells showed a surprising degree of stability. In general, the most stable contact system, electrically and mechanically, was the solder-coated, Ti-Ag system used on the Mariner Mars 1969 solar cells. Author

N71-18681*# Electric Storage Battery Co., Raleigh, N.C. Exide Missile and Electronics Div.
HIGH CYCLE LIFE SEALED SILVER OXIDE-ZINC CELL DEVELOPMENT Final Report, 14 Feb. 1969–20 Jun. 1970
C. D. Farris 8 Sep. 1970 53 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952472)
(NASA-CR-116794; ESR-E-42-70) Avail: NTIS CSCL 10C

Seventy Phase 1 30 amp-h sealed Zn/KOH/AgO cells of 7 different designs have completed 4 months room temperaure charged stand, and 6 months of cycling, 1 cycle per day (50% depth/22 hr. charge/2 hr. discharge). Cells with four layers of fibrous sausage casing and tapered negative plates were still cycling after 170 cycles and more than 10 months wet life. One hundred twenty-nine Phase 2 cells of 6 of the 7 designs revised from Phase 1 have completed 6 months room temperature charged stand and are beginning cycling tests. Phase 1 tests demonstrate that 30 amp-h long cycle life cells can deliver over 170 50% depth of discharge cycles (1 cycle per day) after four months of room temperature charged stand. Author

N71-18698* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD OF USING PHOTOVOLTAIC CELL USING POLY-N-VINYL CARBAZOLE COMPLEX Patent
Alan Rembaum and Allen M. Hermann, inventors (to NASA) Issued 21 Apr. 1970 Filed 4 Apr. 1968) 5 p Cl. 136-89; Int. Cl. H01e15/02; Int. Cl. C08f7/16 Sponsored by NASA

(NASA-Case-NPO-10373; US-Patent-3-507,706; US-Patent-Appl-SN-718752) Avail: US Patent Office CSCL 10B

A method is described of producing an output voltage from a photovoltaic cell utilizing poly-N-vinyl carbazole complexed with iodine as the photovoltaic material. Various approaches are outlined that can be used to form the film of poly-N-vinyl carbazole iodine complex in order to observe and test the photovoltaic effects. Two graphs are presented which depict the spectral and intensity dependence of the photovoltaic effect for different materials tested. D.L.G.

N71-18736*# Heliotek, Sylmar, Calif.

RESEARCH AND DEVELOPMENT OF SILICON SOLAR CELLS FOR LOW SOLAR INTENSITY AND LOW TEMPERATURE APPLICATIONS Quarterly Progress Report

P. Payne 29 Dec. 1970 32 p ref

(Contract NAS2-5519)

(NASA-CR-114280) Avail: NTIS CSCL 10A

Crucible grown silicon was investigated to determine whether the short circuit current-temperature dependence of the low oxygen content float zone and Mon-X or Lopex type silicon could be duplicated with crucible grown silicon by varying the crystal growth parameters to minimize the oxygen concentration. Cells fabricated from this special ingot were compared to cells fabricated from a standard production grown ingot; no improvement in the short circuit current temperature characteristic was realized with the lower oxygen concentration crucible grown cells. Investigation of the broken knee characteristic was oriented toward evaluating the effect of various edge treatments. The edge treatments included grinding the cell edges, applying a liquid glass film and heating to form a passivating layer, etching silicon slabs prior to slicing in order to reduce the mechanical damage at the cell edges, and mesa etching cells. Grinding the cell edges in some cases completely eliminated the broken knee problem, however, in most cases, the broken knee effect was reduced considerably, but not eliminated. The results were similar with application of a glass film to the edges. Author

N71-18740# Arizona Univ., Tucson. Engineering Experiment Station.

THE EFFECT OF SIMULATED FISSION PRODUCTS IN THE INTER-ELECTRODE SPACING OF A THERMIONIC DIODE Final Report, 1 Nov. 1968 – 31 May 1970

Monte V. Davis 1 Nov. 1970 26 p refs

(Contract Nonr-2173(13))

(AD-715809) Avail: NTIS CSCL 10/2

The development of experimental diodes to operate at extremely high temperatures with mixed vapors in the interelectrode spaces is discussed. Attempts at calculating the operational effects of multiple adsorbates on refractory substrates are presented. The theoretical discussion of dielectric breakdown in the environment such as would be found in a nuclear thermionic system is discussed. Author (GRA)

N71-18750# Naval Intelligence Command Washington, D.C. Translation Div.

MARINE THERMOELECTRIC DEVICES AND INSTALLATIONS

Yu. G. Manasyan 7 Dec. 1970 75 p Transl. into ENGLISH from the book 'Sudovye Termoelektricheskie Ustroistva i Ustranovki" Leningrad Sudostroyeniye, 1968 p 151 – 228

(AD-715457; NIC-TRANS-3144) Avail: NTIS CSCL 10/2

Contents: Marine thermoelectric plant operating conditions and principles of regulation (Thermoelectric generator operating conditions and characteristics. Principles of regulation of marine thermoelectric units); Prospects for the use of thermoelectric devices and units in ships (General requirements imposed on marine devices and units. Prospects for the use of thermoelectric cooling devices and heat pumps aboard ship. Prospects for the use of thermoelectric devices and units as marine sources of electric power. Prospects for the use of thermoelectric generators in main ship propulsion plants. Electric propulsion complexes for marine thermoelectric plants). GRA

N71-18963*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.

CAPACITANCE OF SOLAR CELLS AND PANELS UNDER VARIOUS LOAD CONDITIONS

A. Schloss 1 Feb. 1971 13 p refs

(Contract NAS7-100)

(NASA-CR-116822; JPL-TM-33-364) Avail: NTIS CSCL 10A

A solar cell associated with diffusion capacitance was analyzed as directly proportional to the short circuit current capability. Using the sweep loading technique, it was found that the current provided by the diffusion capacitance affects power measurement. A measurement technique is presented to determine cell capacitance. Author

N71-19109*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TEST OF CADMIUM SULFIDE SOLAR CELLS IN A SERIES STRING

Thomas M. Klucher and Anthony F. Ratajczak Washington Mar. 1971 21 p refs

(NASA-TM-X-2231; E-5937) Avail: NTIS CSCL 10A

A vacuum thermal cycling test, simulating an earth orbit environment, was performed on nine cadmium sulfide thin-film solar cells connected in a series string. After 905 cycles, the changes in cell performance parameters were −1.9 percent in maximum power, −2.4 percent in fill factor, −3.4 percent in short-circuit current, and 3.6 percent in open-circuit voltage. A rank correlation analysis demonstrated a definite correlation between change in fill factor and change in shunt resistance. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-18256# Harvard School of Public Health, Boston, Mass. Guggenheim Center for Aerospace Health and Safety.

THE EFFECTS OF PHYSICAL AND SYMBOLIC STRESSORS ON PERCEPTUAL MECHANISMS Final Report

Rose A. McFarland and Warren H. Teichner Jun. 1970 13 p refs

(Grant AF-AFOSR-1575-68)

(AD-715308; AFOSR-70-2619TR) Avail: NTIS CSCL 6/16

The research has had two major activities. (1) An attempt to develop a bridge between basic theory and application over the huge empirical knowledge gap between task and environmental variables on the one hand, and performance measures on the other, and (2) The conduct of experimental studies of relevance to the postulates of the stress theory. A third conceptual activity was added which concerned the question of what tasks should be used in conjunction with environmental simulation studies. Author (GRA)

N71-18363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aerospace Medical Research Lab.

LONG TERM ADAPTATION OF PURSUIT ROTOR

PERFORMANCE TO IMPULSIVE ACOUSTIC STIMULATION Final Report, Apr.–Jun. 1970
C. Stanley Harris Sep. 1970 11 p refs
(AD-715289; AMRL-TR-70-92) Avail: NTIS CSCL 5/10

In a previous experiment, performance on a pursuit rotor task was found to adapt to impulsive acoustic stimulation by the fourth day of exposure. The purpose of the present study was to determine if performance would regain sensitivity to the stimulus after an interval of time. Six subjects who participated in the initial experiment were retested after intervals ranging from five to eight months. After a retraining day, the subjects were presented a retention test day in which the procedure was identical to that used on the four test days of the prior experiment. The stimulus (peak intensity of 112 dB with a 400 millisecond duration) was presented nine times in a semi-random fashion. The results are reported. Author (GRA)

N71-18421*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFLUENCE OF THE PERICAPILLARY PLASMA ON CHEMICAL EXCHANGE FROM BLOOD TO TISSUE
John T. Howe Washington Mar. 1971 15 p refs
(NASA-TN-D-6227; A-2711) Avail: NTIS CSCL 06P

The transport of chemical species from blood to tissues is studied for capillaries that have an extra annulus of plasma outside the endothelium. The equations of flow and diffusive transport are solved in closed form in the blood compatible with transport into the surrounding tissue, which consumes the species according to first order kinetics. Results show that the plasma annulus increases the supply of species and thus the rate of chemical exchange between blood and tissues, raising the concentration (and the consumption rate) in tissue spaces. If permeabilities are reassigned so that the endothelium is very leaky and the blood-tissue interface is the chemical barrier (low permeability), the species concentration the tissue is increased again. The reason is that the blood velocity in the endothelium is much larger than that of the annulus. Thus the high rate of supply of species in the leaky endothelium is available to the annulus, and although the permeability of the blood-tissue interface is low, its large surface area is bathed by a high chemical concentration. The result is an increase in the species flux to the tissues and an increase in concentration. The effect increases with capillary radius (lower capillary hematocrit). Author

N71-18492# Joint Publications Research Service, Washington, D.C.
HYDRODYNAMICS OF XIPHIOIDAE GROUP FISHES
Yu. G. Aleyev 1 Feb. 1971 9 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 49, no. 11, 1970 p 1676–1683
(JPRS-52299) Avail: NTIS

An experimental study of the hydrodynamics of Xiphioidae fishes is reported. Based on experiments in hydrodynamic channels, and in wind and cavitation tunnels, the role of the rostrum and other features of body shape and integumenta of Xiphioidae representatives is shown in the determination of the pattern of distribution of dynamic pressure and other elements of the streamlining pattern important for reducing total hydrodynamic resistance. Author

N71-18493# Joint Publications Research Service, Washington, D.C.
EMISSION OF ULTRASOUND ECHOLOCATING SIGNALS BY COMMON PORPOISE
N. A. Dubrovskiy et al 1 Feb. 1971 8 p refs Transl. into ENGLISH from Akust. Zh. (USSR), v. 16, no. 4, 1970 p 521–525
(JPRS-52291) Avail: NTIS

The common porpoise's ability to detect and differentiate targets and also its ability to perceive auditory signals, is used to present a hypothesis postulating the presence of ultrasound echo-locating signals in this animal. Special experiments confirmed this hypothesis and showed that in performing detecting tasks the common porpoise uses echo-locating signals in a frequency range up to 100 kilocycles per second. Author

N71-18495# Rochester Univ. N.Y. Dept. of Radiation Biology and Biophysics.
BIOLOGICAL EFFECTS OF MICROWAVE EXPOSURE: AN OVERVIEW
Sol M. Michaelson [1970] 14 p refs Presented at Microwave Power Symp., Scheveningen, Neth. Sponsored by AEC
(UR-49-1256; CONF-701010-1) Avail: NTIS

A review of the literature on the biological effects of microwaves is presented. Electrical and scattering properties of tissues are discussed with relation to effects of electromagnetic radiation on organisms. It is emphasized that effects of microwaves are a manifestation of thermal conversion, while the harmful effects of X- or gamma rays are caused by ionization. A discussion of the relative importance of thermal and non-thermal effects of microwaves is given. Studies on cataractogenic effects of microwaves on eyes of rabbits are reviewed. A review of studies on human populations exposed to microwaves includes radar operators and microwave personnel. Studies on lenticular opacities in microwave workers showed that there were no clinically significant defects in terms of decreased visual acuity. NSA

N71-18536# Army Medical Research Lab., Fort Knox, Ky.
REAL-EAR EVALUATION OF EARPLUGS USING ONE-THIRD OCTAVE BANDS OF NOISE Interim Report
James D. Mosko 20 Oct. 1970 10 p
(AD-715748; USAMRL-907) Avail: NTIS CSCL 6/17

The objective of the test was to evaluate the attenuation characteristics of three earplugs using noise bands as the test signal, and to compare the attenuation characteristics of the Sound Sentry protective device using noise bands to those using pure tones. A real-ear attenuation method using noise bands was utilized to evaluate the attenuation characteristics of the earplugs. Comparison of these data with other data obtained in this laboratory and from a manufacturers brochure was accomplished for the Sound Sentry device, and two separate studies from this laboratory were used to compare attenuation data for the V.51R earplug for pure tones and noise signals. GRA

N71-18562*# Cornell Univ., Ithaca, N.Y. Lab. of Soil Microbiology.
SURVIVAL OF SOIL BACTERIA DURING PROLONGED DESICCATION
M. Chen and M. Alexander [1971] 19 p refs
(Grant NGR-33-010-013)
(NASA-CR-116807) Avail: NTIS CSCL 06M

A determination was made of the kinds and numbers of bacteria surviving when two soils were maintained in the laboratory under dry conditions for more than half a year. Certain nonspore-forming bacteria were found to survive in the dry condition for long periods. A higher percentage of drought-tolerant than drought-sensitive bacteria were able to grow at low water activities. When they were grown in media with high salt concentrations, bacteria generally became more tolerant of prolonged drought and they persisted longer. The percent of cells in a bacterial population that remained viable when exposed to drought stress varied with the stage of growth. Author

N71-18573*# National Aeronautics and Space Administration, Washington, D.C.
RELATIONSHIPS BETWEEN CARDIAC VOLUME, BODY WEIGHT, PHYSICAL WORK CAPACITY AND BLOOD VOLUME IN HEALTHY MEN AND WOMEN WITH VARYING RANGE OF PERFORMANCE [BEZIEHUGEN ZWISCHEN HERZVOLUMEN, KOERPERGEWICHT, KOERPERLICHER

LEISTUNGS-FAEHIGKEIT UND BLUTVOLUMEN BEI GESUNDEN MAENNERN UND FRAUEN UNTERSCHIEDLICHER LEISTUNGSBREITE]

K. Musshoff et al Feb. 1971 30 p refs Transl. into ENGLISH from Acta Radiol. (Stockholm), v. 57, 1962 p 377–400
(NASA-TT-F-13439) Avail: NTIS CSCL 06P

An investigation was conducted to establish the relationships between cardiac volume on the one hand and body weight, blood volume, and physical working capacity on the other, as well as the mutual relationships among the four values in a group of men and women with different performance ranges. The test subjects were 36 males 18 to 19 years of age, 39 men 20 to 40 years of age, 25 women, and 44 male outstanding athletes. Correlations established in the study include: (1) The cardiac volume per kilogram body weight is greater for athletes than for untrained men and in the case of the latter greater than for untrained women. (2) The maximum absorption of oxygen and maximum pulse oxygen per kg body weight are highest in athletes and successively decrease in untrained men in the 18 to 19 year age group, untrained men in the 20 to 40 year age group, and women. (3) In the case of athletes and untrained men 18 to 19 years of age, the ratios formed by the cardiac volume and maximum oxygen absorption per minute and per pulse beat are approximately equal. It is moderately increased for men 20 to 40 years of age and considerably so for women. D.L.G.

N71-18788# Washington Univ., Seattle.
OBSERVATIONS OF CARBON DIOXIDE AND PLANT GROWTH IN AN ARCTIC ECOSYSTEM Final Report

John J. Kelley and Philip L. Johnson Nov. 1970 133 p refs
(Contract N00014-67-A-0103-0007)
(AD-715789; SR-8) Avail: NTIS CSCL 6/6

This report presents the results of analyses of atmospheric carbon dioxide and ecological factors at Meade River Camp and at North Meadow Lake (Barrow), Alaska. The data summarize reference gas calibrations used in the CO2 program, with a discussion of methods used to obtain the data for CO2 concentrations in air at both stations. Variations of CO2 in the air, at the ground level, and at 16 m above the ground are given for both the Meade River Station and North Meadow Lake. Meteorological observations are presented for the period of observations. The percent rate of growth of five species of tundra plants is shown, and the correlation between CO2 concentration in the atmosphere and the percent of maximum ground is given. The data for the amounts of chlorophyll and dry weight production in each of four types of communities are presented. A list of publications resulting from the interpretation of these data is included. Author (GRA)

N71-18792# School of Aerospace Medicine, Brooks AFB, Tex.
METHODS FOR STUDYING THE BIOCHEMICAL PROPERTIES OF BACTERIA

Yu. B. Popov 1970 6 p refs Transl. into ENGLISH from Lab. Delo (Moscow), no. 10, 1967 p 621
(AD-715506; SAM-TT-R-1074-1170) Avail: NTIS CSCL 6/1

The purpose of this investigation is to test the simplest, more rapid and economical micromethods, allowing rather complete study of the biochemical properties of bacteria to be performed in short order. The work was performed using standard cultures of the following microorganisms: Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Bacillus cereus, Bacillus mesentericus, Micrococcus pyogenes var. aureus and Bacillus megatherium. Test methods for the following Saccharolytic properties; Test for urease; Test for the capability to form indole; Test for reduction of nitrates; and Test for reduction of nitrites. GRA

N71-18793# School of Aerospace Medicine, Brooks AFB, Tex.
HOMEOSTASIS IN WEIGHTLESSNESS [GEOMEOSTAZ VUSLOVIYAKH NEVESOMOSTI]

B. B. Egorov 1970 12 p Transl. into ENGLISH from the Russian Presented at the Intern. Astronautical Congr. (21st), Constance, West Germany, 4-10 Oct. 1970
(AD-715507; SAM-TT-R-1075-1270) Avail: NTIS CSCL 6/19

A long exposure to weightlessness is accompanied by a readjustment of a number of physiological processes due to disruption of reflexes from the muscles which support activity in the presence of gravity. At the same time, the activity of the muscles of the extremities, a powerful mechanism of extracardial regulation, is changed. The disappearance of hydrostatic pressure in weightlessness is accompanied by redistribution of the blood in the body and by a decrease in the mass of circulating blood. The sharp imbalance between the level of the circulating blood mass, necessary to support the main processes of metabolism, and the mass of circulating blood, stable for conditions of weightlessness, causes periodic and regularly alternating phenomena of polyurea and water retention. This phenomenon is accompanied by a distruption of the electrolyte balance in the body. Author (GRA)

N71-18794# Office of Naval Research, London (England).
INTERNATIONAL SYMPOSIUM ON BEHAVIORAL THERMOREGULATION (FIRST)

Albert R. Dawe 4 Nov. 1970 29 p refs Symp. held at Lyon, France, 7–11 Sep. 1970
(AD-715783; ONRL-C-27-70) Avail: NTIS CSCL 6/16

The Symposium put together a week of papers covering an incredible range of thermoregulatory research. Almost 100 papers were given by representatives of seventeen countries. There was representation from almost every possible sub-specialty of science which writes, thinks, and publishes on problems of thermoregulation. Titles, authors and short remarks are indicated on the majority of papers. Author (GRA)

N71-18837# Scottish Research Reactor Centre, East Kilbride.
A COMPARISON OF METHODS TO ASSESS GEOMETRICAL VARIATIONS OF THE COUNTING RATE IN WHOLE BODY MONITORS

Keith Boddy, Priscilla C. King, Barbara M. Holmes, and Donald M. Dunn Dec. 1968 29 p refs Supported in part by Scot. Hosp. Endowments Res. Trust
(SRRC-31/69) Avail: NTIS

The variation in the counting-rate of a whole-body monitor, due to redistribution of an administered isotope in the body, was investigated by three methods. Point sources in simple water phantoms, a life-like phantom containing simulated organs, and human subjects were studied. The results from all methods were in reasonable agreement. The point source study showed that changes in the depth of the isotope in the body caused greater variation of the counting-rate than changes in longitudinal or lateral position and realistic quantitative estimates of the variation were obtained. It is suggested that this simple method might be a suitable basis for inter-laboratory comparisons. Confirmatory data on human subjects are supplied by the routine use of the whole-body monitor. It is concluded that the use of an elaborate phantom, which may be expensive to purchase, is comparatively time-consuming and is probably unnecessary. Author

N71-18894# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 4, NO. 6, 1970

16 Feb. 1971 132 p refs Transl. into ENGLISH of the book 'Kosmicheskaya Biologiya i Meditsina, Vol. 4, No. 6, 1970' Moscow, Meditsina Publishing House, 1970 p 1–87
(JPRS-52402) Avail: NTIS

Selected articles are presented on cosmonaut selection, the physiological and biological effects of prolonged space flight, and in-flight monitoring and postflight clinical examination of Soyuz 9 crew members. For individual titles, see N71-18895 through N71-18913.

N71-18895# Joint Publications Research Service, Washington, D.C.

GENERAL PRINCIPLES FOR SELECTING COSMONAUTS

N. N. Gurovskiy et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 1–8 refs (See N71-18894 08-04)

Avail: NTIS

The fundamental selection priciples, as well as practical methods for evaluating the health, functional capacity and psychological peculiarities of cosmonaut candidates, are based on careful study and analysis of the combined effect of spaceflight factors on the human body. Three selection stages are discussed: clinical evaluations, hospital examinations, and selection during training. The level of demands placed on different physiological systems is gradually increased from stage to stage. High priority is given to the peculiarites involved in the selection and training of cosmonaut-scientists. In certifying a candidate, particular attention is given to the degree and speed of human body adaptation to the hostile space environment. Author

N71-18896# Joint Publications Research Service, Washington, D.C.

EXPERIMENTAL VALIDATION OF ADMISSIBLE RADIATION DOSES FOR LONG SPACE FLIGHTS

Yu. G. Grigoryev et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 9–16 refs (See N71-18894 08-04)

Avail: NTIS

The results of a two-year study of 204 dogs exposed to chronic gamma irradiation are given. Total tissue doses were 42, 125, and 249 rad. Some of the animals were exposed to repeated irradiation once for four months in addition to chronic irradiation with a dose of 62.5 rad per year. Total absorbed tissue dose from exposure of the two groups to the combined irradiation was 241 and 377 rad. The dose level and exposure rate simulate irradiations which may occur during long space flights. The studies included determinations of hemopoietic, cytological, and immunological parameters. By the end of the two-year experiment some of the dogs which had received the highest doses exhibited changes which can be interpreted as early symptoms of chronic radiation sickness. Author

N71-18897# Joint Publications Research Service, Washington, D.C.

PATHOLOGIC ANATOMY OF DOG KIDNEYS DURING THE AFTEREFFECT PERIOD FOLLOWING IRRADIATION BY HIGH ENERGY PROTONS

B. S. Fedorenko et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 17–22 refs (See N71-18894 08-04)

Avail: NTIS

Renal pathologic anatomy of 17 dogs irradiated with 126- and 510-MeV protons in doses of 250, 350, and 550 rad was investigated two to four years after the exposure. Dystrophic and sclerotic changes were observed in the glomerular and tubular system: enlargement of basal membranes and the glomerular capsule, atrophy of the tubular epithelium, and excessive accumulation of mucopolysaccharides. The degree of structural changes increased with the irradiation dose regardless of proton energy. The changes were slowly progressing to involve mainly vascular disorders and lesions of the interstitial substance of glomerular basal membranes, and were similar to the processes involved in natural aging of the animal body. No specific results of proton exposure were noted. Author

N71-18898# Joint Publications Research Service, Washington, D.C.

DYNAMICS OF MORPHOLOGICAL CHANGES IN THE SUPRAOPTIC NUCLEUS OF THE HYPOTHALAMUS DURING PROLONGED TRANSVERSE ACCELERATION

V. K. Podymov *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 23–29 refs (See N71-18894 08-04)

Avail: NTIS

The dynamics of changes in the supraoptic nucleus of the hypothalamus in 45 white rats exposed to transverse accelerations for 3, 8, 16, and 24 hours was examined. Phase changes in the secretory reaction of the supraoptic nuclei were observed. This indicates direct participation of hypothalamic secretory neutrons in the adaptive reactions of the animal body to accelerations. Author

N71-18899# Joint Publications Research Service, Washington, D.C.

DEPENDENCE OF BIOELECTRIC ACTIVITY OF ANTAGONISTIC MUSCLES OF THE HIND LIMBS OF ANIMALS ON ROTATION DIRECTION AND HEAD FIXATION

Yu. M. Uflyand et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 30–33 refs (See N71-18894 08-04)

Avail: NTIS

Right-to-left and left-to-right horizontal rotation of animals caused an increase in bioelectric activity in tibial antagonistic muscles, and the level and latent period of the reaction. The bioelectric reaction of the antagonistic muscles was also dependent on head fixation. Author

N71-18900# Joint Publications Research Service, Washington, D.C.

MEDICAL SUPPORT AND PRINCIPAL RESULTS OF EXAMINATION OF THE SOYUZ-9 SPACESHIP CREW

Ye. I. Vorobyev et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 34–41 (See N71-18894 08-04)

Avail: NTIS

The collected data indicate that the physiological changes were of a transient or functional nature. The motor and autonomic systems exhibited adaptive changes during the first three or four days. Postflight shifts in vital physiological systems were far more pronounced than were inflight changes. It is suggested that adaptation to the terrestrial environment after prolonged weightlessness involves greater difficulties and places greater demands on the physiological functions than does adaptation to weightlessness. It is concluded that prolonged space missions make it necessary to formulate preventive measures alleviating post-weightlessness adaptation to a terrestrial environment. Author

N71-18901# Joint Publications Research Service, Washington, D.C.

METHOD FOR MONITORING PHYSIOLOGICAL FUNCTIONS OF SOYUZ-9 CREW

A. G. Zerenin et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 42–48 refs (See N71-18894 08-04)

Avail: NTIS

A distinctive characteristic of physiological monitoring of the Soyuz-9 mission was the fact that throughout the flight A. G. Nikolayev and V. I. Sevast'yanov repeatedly put on and removed the bioinstrumentation harness. These procedures, each requiring five to ten minutes, were performed without difficulty. The bioinstrumentation harness induced no unpleasant sensations or skin irritations. The telemetered data were of a high quality and helped to collect reliable information on the cardiovascular and respiratory functions of the cosmonauts during the extended space flight. Author

N71-18902# Joint Publications Research Service, Washington, D.C.

RESULTS OF ROUTINE MEDICAL MONITORING OF COSMONAUTS DURING FLIGHT ON THE SOYUZ-9 SHIP

A. A. Butusov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1970 p 47–53 refs (See N71-18894 08-04)
Avail: NTIS

Peculiarities of in-flight medical monitoring associated with the specific characteristics of an extended space flight are discussed. The physiological changes induced by the 18-day flight, as well as circulatory reactions of a provocative test involving a standard physical load are described. The high motor activity and emotional stress associated with implementing the extensive program of scientific experiments appeared to bring about a lower vagotonic reaction as compared with that during previous manned space flights. This was suggested by the fact that in-flight cardiac and respiration rates were very similar to preflight levels. The type and level of physiological changes mainly corresponded to the operations performed during flight. The working capacity of crew members remained high throughout the entire mission. Author

N71-18903# Joint Publications Research Service, Washington, D.C.

RESULTS OF CLINICAL EXAMINATION OF A. G. NIKOLAYEV AND V. I. SEVASTYANOV

N. S. Molchanov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 54–57 refs (See N71-18894 08-04)
Avail: NTIS

No pathological conditions were noted in crew members during the flight. Functional changes similar to those observed during earlier flights were detected. Immediately upon return to earth the following disturbances were noted: skin pallor, moderate hyperemia of the mucosa in the upper respiratory passages, congestion of scleral vessels, eyelid edema, noticeable muscular atrophy of the lower limbs, and reduced muscle tone. During the first postflight day a decrease in the periosteal and tendon reflexes and an inhibition of abdominal reflexes were reported. Muscular pain which had been noted on the first day increased by the fifth day due to greater mobility. Statokinetic and sensomotor disorders were observed. Dynamic monitoring revealed that rehabilitation processes developed in a gradual manner. Author

N71-18904# Joint Publications Research Service, Washington, D.C.

CHANGE IN OPTICAL DENSITY OF BONE TISSUE AND CALCIUM METABOLISM IN THE COSMONAUTS A. G. NIKOLAYEV AND V. I. SEVASTYANOV

Ye. N. Biryukov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 58–63 refs (See N71-18894 08-04)
Avail: NTIS

The results of pre and postflight evaluations of bone tissue optical density and the calcium content in the blood serum and urine are given. Both cosmonauts exhibited an in-flight increase in calcium excretion in the urine and a decrease in bone optical density in an X-ray examination. In addition, one of them exhibited an insignificant increase in the postflight blood serum calcium content. The calcium excretion and bone optical density rapidly returned to normal levels after return to earth. These changes seem to be closely associated with different functional demands on the musculoskeletal system under conditions of weightlessness and terrestrial gravity. Author

N71-18905# Joint Publications Research Service, Washington, D.C.

SPACE FLIGHT EFFECT ON THE NEUROMUSCULAR SYSTEM OF COSMONAUTS

M. A. Cherepakhin et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 64–69 refs (See N71-18894 08-04)
Avail: NTIS

The results of medical evaluations of Soyuz-9 crew members are given, including data on the effect exerted by weightlessness on the neuromuscular system. Muscle tone was evaluated on the basis of muscle firmness and bioelectric activity. Reflex excitability of the neuromuscular system was studied. After exposure to weightlessness the following changes were noted: decreased strength and tone of posture muscles, increased reflex excitability of the neuromuscular system, and a decreased circumference of the lower extremities. Author

N71-18906# Joint Publications Research Service, Washington, D.C.

REGULATION OF ERECT POSTURE OF COSMONAUTS AFTER AN 18 DAY ORBITAL FLIGHT

B. N. Petukhov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 70–77 refs (See N71-18894 08-04)
Avail: NTIS

Displacements of the general center of gravity were registered by stabiligraphic methods and circulation parameters were monitored. After return to earth significant changes in the frequency and amplitude of changes in the general center of gravity were noted, which indicate distinct static disturbances. Changes in the rhythm of cardiac contractions and increase in mean arterial pressure were observed. These parameters gradually returned to normal by the tenth day following the flight. Author

N71-18907# Joint Publications Research Service, Washington, D.C.

SKIN AUTOMICROFLORA AND SOME INDICES OF NATURAL IMMUNITY OF THE COSMONAUTS A. G. NIKOLAYEV AND V. I. SEVASTYANOV BEFORE AND AFTER FLIGHT

S. N. Zaloguyev et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 78–84 refs (See N71-18894 08-04)
Avail: NTIS

The 18-day Soyuz-9 space flight resulted in dysbacteriotic disturbances in the composition of skin and nasal cavity automicroflora. These disturbances are accompanied by changes in some natural immunity parameters. Author

N71-18908# Joint Publications Research Service, Washington, D.C.

DIET OF SOYUZ-9 SPACESHIP CREW MEMBERS

V. P. Bychkov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 85–87 (See N71-18894 08-04)
Avail: NTIS

The diet consumed by Soyuz-9 crew members consisted of canned foods, analytically determined as containing 139 g of proteins, 88 g of fats, and 345 g of carbohydrates. The caloric content of the daily diet was 1903 cal. The diets were supplemented with essential amino acids and contained normal concentrations of other irreplaceable nutrient ingredients. The diets provided a high work capacity for the cosmonauts, helping them to implement the stipulated flight program. Author

N71-18909# Joint Publications Research Service, Washington, D.C.

SPACE FLIGHT EFFECT ON THE ENZYME SECRETION FUNCTION IN THE DIGESTIVE SYSTEM OF COSMONAUTS

K. V. Smirnov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 88–95 refs (See N71-18894 08-04)
Avail: NTIS

Postflight studies of the enzyme secretion function of the digestive system of Soyuz-9 crew members reveal phase changes in the activity of ivestigated enzymes. During the first postflight day the following shifts were detected: inhibition of the salivary glands, activation of abdominal and pancreatic enzymes, and lack of noticeable changes in the small intestine. These shifts in the

functional state of the gastrointestinal tract are adaptive and indicative of a digestive system response to weightlessness. Author

N71-18910# Joint Publications Research Service, Washington, D.C.

RESULTS OF OTORHINOLOGICAL EXAMINATION OF SOYUZ-9 SPACESHIP CREW MEMBERS

I. I. Bryanov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 96-99 refs (See N71-18894 08-04)

Avail: NTIS

The physiological reactions of the vestibular and auditory analyzers of the Soyuz 9 crew members were investigated. Preflight examination revealed definite changes in the otorhinolaryngological organs which were well compensated under conditions of terrestrial loading. During flight there were changes in the activity of analyzer systems, particularly of the vestibular analyzer. Adaption to weightlessness varied from one to three days between the two crew members. Both cosmonauts noted changes in the sense of smell and taste, which returned to normal shortly after landing. The postflight period of readaptation to terrestrial conditions was characterized by general asthenia, autonomic-vascular reactions (including the nasal cavity vascular system), and impairment of statics and coordination. Recovery to normal activity displayed varying dynamics and duration. R.B.

N71-18911# Joint Publications Research Service, Washington, D.C.

DYNAMICS OF ORTHOSTATIC STABILITY OF COSMONAUTS AFTER FLIGHT ABOARD THE SOYUZ-9 SPACESHIP

V. V. Kalinichenko et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 100-112 refs (See N71-18894 08-04)

Avail: NTIS

The dynamics of the orthostatic stability of the Soyuz 9 crew members was examined before and after their 18-day flight using five-minute active and ten-minute passive tests. The response to orthostatic tests was evaluated on the basis of medical monitoring and hemodynamic, gas exchange, and external respiration measurements. Both cosmonauts exhibited a postflight decrease in orthostatic stability which was restored slowly and nonmonotonically. The response of both cosmonauts was similar. The degree of orthostatic instability appears to be dependent on flight duration. Author

N71-18912# Joint Publications Research Service, Washington, D.C.

EFFECT OF PROLONGED CONFINEMENT OF MAN IN A SOYUZ-9 SIMULATOR ON THE FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM

L. P. Salmanov et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1971 p 113-117 refs (See N71-18894 08-04)

Avail: NTIS

The cardiovascular effect of 19- to 23-day confinement of man in a Soyuz 9 simulator was studied during normal and modified work and rest cycles. In an experiment with a normal work and rest schedule there were no significant changes in the functional state of the circulatory system. Significant circulatory disturbances were observed in experiments with a modified work and rest schedule. Author

N71-18913# Joint Publications Research Service, Washington, D.C.

ELECTROENCEPHALOGRAPHIC CHANGES AND BEHAVIORISTIC REACTIONS UNDER THE INFLUENCE OF ACUTE HYPOXIA

N. A. Agadzhanyan et al *In its* Space Biol. and Med., Vol. 4, No. 6, 1970 16 Feb. 1970 p 118-126 refs (See N71-18894 08-04)

Avail: NTIS

Behavioristic, conditioned reflex, and motivation reactions, as well as concomitant changes in the EEG, ECG, and blood oxygen concentration were determined in experiments on rabbits and human subjects exposed to rapidly increasing hypoxia. It was found that these physiological changes correlate with behavioral reactions. Author

N71-18926*# Illinois Univ., Urbana. Lab. for Ergonomics Research.

A STUDY OF THE THERMAL BEHAVIOR OF LIVING BIOLOGICAL TISSUE WITH APPLICATION TO THERMAL CONTROL OF PROTECTIVE SUITS

A. Shitzer, J. C. Ohato, and B. A. Hertig Jan. 1971 217 p refs

(Grant NGR-14-005-103)

(NASA-CR-116873; ME-TR-207) Avail: NTIS CSCL 06P

A biothermal model of living tissue was studied which permits inclusion of the effects of blood flow, local heat generation, conduction, and storage of heat on the heat transfer processes occurring in the living tissue. A second order, partial differential equation, the bioheat equation, was obtained for the model. Due to the lack of reliable and detailed data on the thermophysical properties involved, the tissue is assumed to be isotropic and homogeneous and all properties are assumed to be constant. Transient, as well as steady-state, closed form, analytical solutions were obtained for cylindrical and rectangular geometries, and for various parameters. Author

N71-19017*# Sandia Corp., Albuquerque, N.Mex.

AN APPROACH TO COMPUTERIZED BACTERIAL IDENTIFICATION

Richard T. Dillon, Sr. Nov. 1970 86 p refs Sponsored in part by AEC

(NASA Order W-12853)

(NASA-CR-116815; SC-RR-70-779) Avail: NTIS CSCL 06M

The analysis and design is described of a general approach to bacterial identification which readily lends itself to computerization. This approach has been applied to the microbial sampling data of four Apollo spacecraft. These data were supplied by the PHS Spacecraft Bioassay Laboratory who obtained them in connection with NASA's lunar planetary quarantine responsibility. The approach described here was found to agree quite well with the PHS identifications assigned in the laboratory. The computer program used in this application is described in detail, and some analysis of the results of the use of this computer program with the Apollo data is given. Other possible applications of the general approach to bacterial identification described are mentioned. Author

N71-19018*# Houston Univ., Tex. Dept. of Biology.

TWO POPULATIONS OF ALIPHATIC HYDROCARBONS OF TERATOMA AND HABITUATED TISSUE CULTURES OF TOBACCO

John D. Weete, S. Venketeswaran, and John L. Laseter [1970] 11 p refs Prepared in cooperation with Louisiana State Univ., New Orleans

(Contract NSR-09-051-001)

(NASA-CR-116887) Avail: NTIS CSCL 06P

Teratoma and habituated tissue cultures of tobacco grown under identical conditions were examined for the presence of paraffinic hydrocarbons. The teratoma tissues contained n-C29, 2-methyl C30 (iso C31) and n-C31 as the major alkane components and their distribution pattern was qualitatively identical to the seedling tissue alkanes (C22 - C34). Habituated tissues contained a different population of alkanes ranging in carbon chain length

from C17 to C28. The predominant alkane components were n-C23, n-C22, and n-C24 in decreasing concentrations respectively. A tissue culture system is presented where the population 1 hydrocarbons (C16 - C28) are present and synthesized separately and independently of population 2 hydrocarbons (C27 - C34). Author

N71-19023# Joint Publications Research Service, Washington, D.C.

INTERACTION OF THE ANALYZERS IN THE COMMON DOLPHIN WHEN DISCRIMINATING GEOMETRIC FIGURES UNDER WATER

A. Bagdonas et al 22 Feb. 1971 9 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatelnosti im I. P. Pavlova (Moscow), no. 5, 1970 p 1070–1074
(JPRS-52444) Avail: NTIS

The ability to discriminate between geometric figures with different optical and acoustic properties presented under different visibility conditions was developed in a dolphin by means of the motor-food conditioned reflex method. Squares and triangles were made of ebonite and Plexiglas, and experiments were run from 9 to 11 am and from 8 to 10 pm. Under adverse conditions for the functioning of the echo-location analyzer, the dolphin used mostly vision to discriminate the figures. When conditions were difficult for visual discrimination, it used its echo-location analyzer. The spatial orientation of dolphins under water involves the close interaction of the visual and acoustic analyzers. Author

N71-19051# Joint Publications Research Service, Washington, D.C.

SPACE BIOLOGY AND MEDICINE, VOLUME 4, NO 5, 1970

7 Jan. 1971 142 p refs Transl. into ENGLISH of the book 'Kosmicheskaya Biologiya i Meditsina, Vol. 4, No. 5, 1970' Moscow, Meditsina Publishing House, 1970 p 1–87
(JPRS-52121) Avail: NTIS

Papers are presented on space biology and medicine including bioastronautics, life support systems, and spacecraft environment research. For individual titles see N71-19051 to N71-19077.

N71-19052# Joint Publications Research Service, Washington, D.C.

STUDY OF CONTROL OF THE CARBON DIOXIDE CONCENTRATION IN AN ANIMAL CHAMBER DURING ATMOSPHERIC REGENERATION BY CHLORELLA

V. I. Saukin et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 1–6 refs (See N71-19051 08-04)
Avail: NTIS

An experimental study was made of a system for controlling the CO2 concentration in an animal chamber involving the use of Chlorella as a biological component. Culture productivity was controlled by step-by-step changes in the illumination of the reactor surface; correlated with a known deviation of the CO2 concentration. The accuracy achieved in stabilizing this value was 0.5% CO2. Spontaneous fluctuations in culture productivity and changes in animal gas exhange were approached as changes affecting the control system. An analysis of the experimental data yielded the numerical values of these changes. In terms of the dynamic characteristics, the tested model is close to the CO2 system in a manned space cabin. Author

N71-19053# Joint Publications Research Service, Washington, D.C.

CHLORELLA CULTIVATION FOR CONTROLLING TOXIC GASEOUS CONTAMINANTS IN THE ATMOSPHERE

V. D. Rogozkin et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 7–14 refs (See N71-19051 08-04)
Avail: NTIS

The possibility is discussed of using Chlorella suspensions for absorbing toxic gaseous contaminants produced by heterotrophic organisms, including man, in an isolated environment. The experimental results show that the tested contaminants do not accumulate in the atmosphere of a closed Chlorella-animal system; although the load is several times greater than normal due to the decomposition of nonutilizable wastes. Author

N71-19054# Joint Publications Research Service, Washington, D.C.

PREVENTION OF RADIATION DAMAGE DURING SPACEFLIGHT

V. D. Rogozkin et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 15–20 refs (See N71-19051 08-04)
Avail: NTIS

The effectiveness of two types of radio-protectants, chemical and biological, was studied using short- and long-term irradiation of animals. Biological radioprotectants (amino acids, bacterial polysaccharides, hormones, and vitamins) gave a 16 to 25 percent increase in the number of mice surviving after prolonged irradiation. It is concluded that biological radioprotectants may well be used during spaceflight. Author

N71-19056# Joint Publications Research Service, Washington, D.C.

EFFECTIVENESS OF SHIELDING DIFFERENT BODY PARTS DURING REPEATED PROTON IRRADIATION

G. F. Nevskaya et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 25–29 refs (See N71-19051 08-04)
Avail: NTIS

Dogs were exposed to proton irradiation (700 rad, two exposures of 350 rad each at 45-day intervals). The pelvic zone and upper portion of the abdomen, constituting 15 percent of the total body weight, were exposed. The protective effect was found to be related to the extent of the undamaged portion of the bone marrow. This amounted to 15 percent and 5 percent of the total bone marrow in the dog skeleton when the pelvis and abdomen, respectively, were shielded. During single or repeated irradiations with the minimum absolutely lethal doses, shielding of 5 percent of the bone marrow failed to repair hemopoiesis to a sufficient degree and the changes in the tested parameters were greater than in animals with 15 percent of the bone marrow shielded. These changes were manifested not so much in hemopoiesis inhibition as in the rate and degree of bone marrow repair and the level of restoration of blood indices. Author

N71-19057# Joint Publications Research Service, Washington, D.C.

USE OF A UNILATERAL LABYRINTHECTOMY MODEL FOR EVALUATING THE EFFECT OF DRUGS ON THE VESTIBULAR FUNCTION

Ye. L. Epshteyn et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 30–35 refs (See N71-19051 08-04)
Avail: NTIS

The effect of different intramuscularly injected drugs on functional-loss nystagmus developed in animals after a unilateral labyrinthectomy was investigated in guinea pigs. It was found that central M- and N-cholinolytics, adrenomimetics, and allylthiourea decreased, whereas cholinesterase inhibitors and adrenolytics increased the frequency of this form of nystagmus. It is suggested that unilateral labyrinthectomy can be successfully used as a model for evaluating and selecting antimotion drugs. Author

N71-19058# Joint Publications Research Service, Washington, D.C.

ISCHEMIC DEAFFERENTATION OF STRIATED MUSCLE TISSUE

V. I. Savchuk et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 36–37 (See N71-19051 08-04)
Avail: NTIS

On the basis of acute experiments on cats under combined chloralose-urethan narcosis, a study was made of the influence of acute impairment of circulation (ischemia) on the functional state of afferent receptors of the quadriceps femoris muscle. Criteria were the intensity of spontaneous activity of the sensitive fibers isolated from the split femoral nerve, intensity of the activation reaction arising with dilatation of the muscles by weights of 20, 50, and 100 g, and impairment in the relationship between spontaneous and induced impulsation. Author

N71-19059# Joint Publications Research Service, Washington, D.C.

CHANGES IN CIRCULATING BLOOD VOLUME DURING LOWER BODY NEGATIVE PRESSURE EXPOSURE

I. S. Balekhovskiy et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 38–42 refs (See N71-19051 08-04)
Avail: NTIS

A modified method is given for measuring the circulating blood volume. The method is based on calculations of the carboxyhemoglobin concentration in the blood after inhalation of a known quantity of carbon monoxide. The method was tested during exposure to lower body negative pressure (LBNP) (−80 mm Hg) for reducing the circulating blood volume. Changes in carboxyhemoglobin concentration were observed in the experiment and control. During the tenth minute of the LBNP exposure, the circulating blood volume decreases significantly but the level of this decrease does not determine individual tolerance to the test. Author

N71-19060# Joint Publications Research Service, Washington, D.C.

CHANGES IN PERMEABILITY OF THE HEMATO-OPHTHALMIC BARRIER OF RABBITS AFTER THEIR EXPOSURE TO ACCELERATIONS

Z. N. Nekhilnitskaya et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 43–50 refs (See N71-19051 08-04)
Avail: NTIS

Rabbits were subjected to single and repeated accelerations of 10 g for four minutes. At different times after acceleration, their anterior chambers were examined for intravenously injected fluorescein. Following a single exposure the changes, though showing great variability, were as follows: during the first hours the penetration of fluorescein was accelerated and during the next 15 days it was limited and elimination was delayed. A repeated exposure six days later produced more significant changes. During daily exposures for eight days the reaction level, regardless of its pattern, became stabilized at an increase during the postacceleration period. The changes persisted for over a month after the exposure. Author

N71-19062# Joint Publications Research Service, Washington, D.C.

RELATIVE BIOLOGICAL EFFECTIVENESS OF MULTICHARGED IONS DURING SINGLE IRRADIATION OF CHLORELLA

L. K. Vekshina et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 58–62 refs (See N71-19051 08-04)
Avail: NTIS

The dose dependence of relative biological effectiveness of accelerated C-6 and C-12 ions was determined. An increase in the inactivation cross section with an increase in linear energy transfer of ionizing radiation was demonstrated. A dose-dependent change in Chlorella mutability was observed. Author

N71-19063# Joint Publications Research Service, Washington, D.C.

EFFECT OF IONIZING RADIATION ON FOOD PRODUCTS

V. P. Bychkov et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 63–68 refs (See N71-19051 08-04)
Avail: NTIS

Experimental data are presented on the effect of gamma irradiation, in doses of 35,000 and 70,000 rad, on the physicochemical and organoleptic properties of casein, sunflower seed oil, yeast, and oil concentrates of vitamins A and D. A single irradiation reduced some essential amino acids, destroyed significant quantities of water-soluble and small quantities of fat-soluble vitamins in foods, and increased the concentration of peroxides in sunflower seed oil. Author

N71-19064# Joint Publications Research Service, Washington, D.C.

HUMAN BODY IMMUNOLOGICAL REACTIVITY DURING A 120 DAY DIET WITH DEHYDRATED FOODS

V. P. Bychkov et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 69–76 refs (See N71-19051 08-04)
Avail: NTIS

Data collected during a 180-day experiment are presented. Six volunteers 25 to 31 and weighing 68 to 91 kg were tested. During December and May, the subjects were given baseline diets of natural foods providing 3,100 calories per day. Over a 120-day period (January through April), they were given test diets similar in composition to the baseline diets, but dehydrated components were consumed. During the first two months, lysozymic activity decreased in the saliva and blood serum, dysbacteriosis developed in the oral cavity and pharynx, and the ratio of the protein fractions in the blood serum changed. During the third month, these parameters returned to a normal level and by the end of the experiment the phagocytic activity of leukocytes had increased. Author

N71-19065# Joint Publications Research Service, Washington, D.C.

STUDY OF STREPTOCOCCAL FLORA OF THE HUMAN ORAL CAVITY DURING PROLONGED CHAMBER CONFINEMENT

V. I. Drozdova et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 77–83 refs (See N71-19051 08-04)
Avail: NTIS

Results of studies of human oral cavity streptococcal flora during year-long chamber confinement of human subjects are presented. It was found that long-term confinement of human subjects in an isolated environment results in transfer of streptococci from subject to subject; this is accompanied by an increase in the total number of streptococci and the number of hemolytic microbes. Author

N71-19066# Joint Publications Research Service, Washington, D.C.

RENAL OSMOREGULATION FUNCTION OF SOYUZ-4 AND SOYUZ-5 CREW MEMBERS

A. I. Grigoryev et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 84–90 refs (See N71-19051 08-04)
Avail: NTIS

Crew members were examined for the renal osmoregulation function before and after flight. On the second day after the flight they were given a 2 percent water load. The osmolar concentration, Na and K blood concentration, the corresponding concentration in the daily urine and every urine discharge, were determined after the load. Glomerular filtration was also measured using endogenous creatinine. The water load indicated an increased activity of the

osmoregulation system. After the load all cosmonauts excreted 1.3 to 2.8 times less fluid. The osmolar concentration and index of the most diluted urine portion increased and the clearance of osmotically free water was reduced; the osmolar and Na concentrations in the blood plasma increased. The glomerular filtration rate changed insignificantly. No differences were detected in the postflight response of command pilots and those who emerged into space. Author

N71-19067# Joint Publications Research Service, Washington, D.C.

PRINCIPAL CHANGES IN THE HEALTHY HUMAN BODY AFTER A 120 DAY BED CONFINEMENT

V. V. Parin et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 91–98 refs (See N71-19051 08-04)
Avail: NTIS

Subjects were given pituitrin, deoxycorticosterone acetate, and nerobol to prevent possible disturbances in mineral and protein metabolism. Examinations made once every 10 to 15 days revealed polymorphic changes in almost all systems in the human body. Clinical, physiological and metabolic changes increased with the experimental time, forming distinct clinical symptoms and syndromes by the end of the second month. The following syndromes were most clearly expressed: autonomic-vascular dysfunction, asthenization, allergy, hemocoagulation disturbance, occasionally accompanied by prethrombotic abnormalities, muscular atrophy, aggravated by muscular atony and disordered bioelectric activity. Mineral metabolism was disturbed, diuresis was negative, and weight losses progressively increased until the third month of the hypokinetic condition, after which a tendency to return to the baseline values was noted. The most distinct changes were observed in Ca metabolism. Nerobol gave a good therapeutic effect, but pituitrin and DOCA were ineffective. Author

N71-19068# Joint Publications Research Service, Washington, D.C.

STATE OF NERVOUS AND MUSCULAR SYSTEMS IN SOYUZ-4 AND SOYUZ-5 CREW MEMBERS

L. I. Kakurin et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 99–104 refs (See N71-19051 08-04)
Avail: NTIS

Reflex excitability of the nervous and muscular systems of four cosmonauts was studied by provocative testing before and after flight. Cosmonauts with high reflex excitability exhibited a decrease in the biopotentials generated by the patellar reflex in response to light and heavy physical loads. After the flight, their reflex excitability fell below the preflight level. Cosmonauts with low reflex excitability exhibited insignificant changes in their response to physical loads both before and after the flight. All cosmonauts exhibited higher levels of tendon reflexes at rest after the flight in comparison with the preflight levels. The more pronouced decrease in the muscle biopotentials accompanying the patellar reflex during physical loads after the flight indicates some deterioration of the functional state of the nervous and muscular systems in these cosmonauts. Author

N71-19069# Joint Publications Research Service, Washington, D.C.

MATHEMATICAL ANALYSIS OF DIURNAL CORRELATIONS BETWEEN THE INDICES OF CEREBRAL AND SYSTEMIC CIRCULATION

V. V. Skryabin et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 105–109 refs (See N71-19051 08-04)
Avail: NTIS

Ten healthy test subjects were kept under moderate bed rest conditions. Rheoencephalograms, transverse rheograms of the body, arterial pressure, and pulse rate were simultaneously registered. The data were processed by computer. Diurnal variations in pulse blood filling of the brain were observed; they increased during the daytime and decreased at night. Linear regression equations were derived for determining the ohmic amplitude of rheoencephalograms using several systemic circulation baseline indices. Author

N71-19070# Joint Publications Research Service, Washington, D.C.

CONDITIONS FOR THE GROWTH AND COMPRESSION OF GAS BUBBLES IN BODY PHYSICAL SYSTEMS AND TISSUES

V. P. Nikolayev *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 110–118 refs (See N71-19051 08-04)
Avail: NTIS

Peculiarities of gas bubbles in physical systems and living tissues are described with emphasis on the problem of bubble statics. Absolute stability of a single bubble in a supersaturated solution of small volume is demonstrated theoretically. The effect of bubbles formed in the tissue during decompression on the elimination of inert gas from the tissue is qualitatively evaluated. The change in the initial distribution of inert gas in the body brought about by bubble transfer is discussed. It is concluded that the resorption of wandering bubbles settling in poorly perfused tissue can be accelerated only by means of body recompression to a pressure exceeding the initial level. Author

N71-19071# Joint Publications Research Service, Washington, D.C.

OTOLITHIC REACTIONS IN ANIMALS ACCOMPANYING INTRAVENOUS INJECTION OF SODIUM BICARBONATE

G. I. Gorgiladze et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 119–121 refs (See N71-19051 08-04)
Avail: NTIS

Four experiments are discussed in which six rabbits and two cats were intravenously injected with sodium bicarbonate in an 8% solution in a dose of 10ml. Prior data on otolithic reactions served as a test control. Results show that neither single nor multiple injections provided changes in any way different from the control otoliths. Author

N71-19072# Joint Publications Research Service, Washington, D.C.

EFFECT OF BREATHING 98 PERCENT OXYGEN ON THE SELF-STIMULATION AND AVOIDANCE REACTIONS IN RABBITS

N. A. Agadzhanyan et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 122–123 refs (See N71-19051 08-04)
Avail: NTIS

Results are presented of a study of the behavioristic and emotional reaction in rabbits when breathing virtually pure oxygen (98 percent) at a pressure of 760 mm. The self-stimulation and avoidance method with electric stimulation of the hypothalamus was used. Author

N71-19073# Joint Publications Research Service, Washington, D.C.

MORPHOLOGY OF THE LIVER AND SKELETAL MUSCLES DURING HYPOKINESIA AND A PROTEIN DEFICIT

G. P. Bykov et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 124–126 refs (See N71-19051 08-04)
Avail: NTIS

Partial results are presented of a many-sided study in alimentary protein inadequacy caused by a reduction of the total protein in the diet of experimental animals kept under hypokinetic conditions to 3 percent. Hypokinesia was induced by placing the

animals in tight individual cages. Histologic and histochemical investigations were made of the tissues from the liver and skeletal muscles (gastrocnemius and quadriceps femoris muscles) in 44 nonlinear white male rats. Author

N71-19074# Joint Publications Research Service, Washington, D.C.

STRAIN GAUGE SENSING ELEMENT FOR REGISTERING ISOMETRIC CONTRACTIONS OF SKELETAL MUSCLES

Yu. M. Bazzhin et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 127–128 (See N71-19051 08-04)
Avail: NTIS

A strain gauge sensing element is described fabricated for in vivo registry of individual and tetanic responses of the skeletal muscles in rats (extensor digitorum, soleus, plantaris) when working in an isometric regime. The gauge can also be used for working with the muscles of other animals, provided that the maximum force which they develop does not exceed 400 g. Author

N71-19076# Joint Publications Research Service, Washington, D.C.

FORTY-FIRST ANNUAL CONGRESS OF THE AMERICAN AEROSPACE MEDICAL ASSOCIATION

I. B. Krasnov *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 133–134 (See N71-19051 08-04)
Avail: NTIS

The organization and themes of the annual congress meeting on aviation and space medicine are mentioned. A listing of the 29 congress sections is included. E.C.

N71-19077# Joint Publications Research Service, Washington, D.C.

WORK OF THE AEROSPACE MEDICINE SECTION OF THE MOSCOW PHYSIOLOGICAL SOCIETY IN 1969

I. Khazen et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 135–137 (See N71-19051 08-04)
Avail: NTIS

Results of several aviation and space medicine investigations are cited. Mention is also made of the content of research papers presented at various conferences and meetings during the year. E.C.

N71-19094# Joint Publications Research Service, Washington, D.C.

THE BIOELECTRIC ACTIVITY OF VARIOUS STRUCTURES OF THE RABBIT BRAIN UNDER THE COMBINED ACTION OF RADIOACCELERATION AND IRRADIATION

S. A. Akopyan et al 26 Feb. 1971 13 p refs Transl. into ENGLISH from Biol. Zh. Arm. (Erevan), v. 23, no. 10, 1970 p 3–12
(JPRS-52488) Avail: NTIS

The changes in the bioelectric potentials in various zones of the cortex, the reticular formation and hypothalamus, the threshold and duration of the spasmodic activity, and the change in certain vegetative functions were studied under the combined action of acceleration and irradiation. The animals were subjected to an acceleration of 3 to 5 g on a centrifuge, and to an X-ray dose of 700 to 800 R. Among the findings are the following: Adequate stimulation of the vestibular apparatus by rotation induces a generalized activation of the cortex and subcortex with a decrease in the threshold of electroconvulsive responses. After irradiation there was an increase in amplitude of the slow waves in the EEG, especially pronounced in the cortex. The electrical changes observed in the first hours after irradiation are not the result of profound damages to the nerve elements, since recovery occurs comparatively rapidly. A decrease in the resistance of the organism to acceleration after irradiation was established. N.E.N.

N71-19110# Joint Publications Research Service, Washington, D.C.

LIFE IN SPACE

O. G. Gazenko 2 Mar. 1971 7 p Transl. into ENGLISH from Priroda (Moscow), 1970, no. 10 p 80–82
(JPRS-52514) Avail: NTIS

A question and answer session with O. G. Gazenko, corresponding member of U.S.S.R. Academy of Sciences, is presented on human life maintainance during space flight. Viability of microflora, life on Mars and Venus, psychological effects of prolonged space flight, and life support systems are briefly discussed. J.A.M.

N71-19123# Joint Publications Research Service, Washington, D.C.

DOLPHINS IN THE SERVICE OF MAN

16 Feb. 1971 8 p Transl. into ENGLISH from Morsk. Sb. (Moscow), no. 11, 1970 p 74–76
(JPRS-52395) Avail: NTIS

A generalized account of the intelligence, speed, and conversational ability of the dolphin is presented. It is concluded that the dolphin's attachment to man and its amazing natural abilities make it useful for oceanographic exploration. F.O.S.

N71-19124# Joint Publications Research Service, Washington, D.C.

CLARIFICATION OF THOUGHT PROCESSES DURING PROBLEM SOLVING

V. P. Savelyev 16 Feb. 1971 9 p refs Transl. into ENGLISH from Filosofska Dumka (Kiev), no. 5, 1970 p 84–89
(JPRS-52397) Avail: NTIS

The effects of the awareness of thought processes in the recreation of past experiences was studied using exercises in the Russian language with 5th graders. The results show that simulation through questions, and creation of problem situations conductive to deeper awareness of self-activity help to recreate past experiences more fully and quickly. It is concluded that grammar should be repetitive and presented in various problematic situations. F.O.S.

N71-19125*# Stanford Univ., Calif. Information Systems Lab.

THE DYNAMIC CHARACTERISTICS OF HUMAN SKELETAL MUSCLE MODELED FROM SURFACE STIMULATION

Jean A. Tennant Washington NASA Feb. 1971 113 p refs
(Grant NGR-05-020-007)
(NASA-CR-1691; SU-TR-6303-1) Avail: NTIS CSCL 06P

A mathematical model for the behavior of the muscle group comprised by the biceps and the brachialis was sought taking into account the changes in muscle tension due to the inertia of the moving masses. Isotonic and isometric experiments were formulated to allow the explicit characterization of the equations for the postulated mechanism. These experiments involved the artificial stimulation of the muscles via a surface electrode, located at the motor point of the muscle group. In the isotonic experiments, external loads were simultaneously applied to the forearm by means of an electric torque motor. The electric motor was controlled not only as a torque producing device, but also as a regulator to compensate for developing inertial loads during accelerated motions, as well as for the changing geometry of the arm/muscle system. The stimulus waveforms were provided digitally. Author

N71-19313*# Chicago Univ., Ill. Dept. of Biophysics.

CELL FINE STRUCTURE AND FUNCTION: PAST AND PRESENT

Humberto Fernandez-Moran *In its* Electron Microscopy in Microbiol. and Lunar Rock Analysis Dec. 1970 12 p refs Repr. from Exptl. Cell Res., v. 62, 1970 p 90–101 (See N71-19311 08-14)
Avail: NTIS CSCL 06C

Problems of nerve membrane ultrastructure which are particularly suitable for correlated electron microscopic investigations are discussed. The organization of cell membranes and of associated multi-enzyme and macromolecular components which carry out energy and information transduction functions is studied. The association of nucleic acids and the protein synthetic machinery with cell membranes is investigated to gain a better understanding of membrane biosynthesis. This includes (1) a study of DNA and RNA conformations associated with membranes in chloroplasts, mitochondria and nerve cells; and (2) study of RNA polymerase and its participation in the differential RNA transcription upon DNA templates. Author

N71-19314*# Chicago Univ., Ill. Dept. of Biophysics.
HIGH RESOLUTION ELECTRON MICROSCOPY OF CELL MEMBRANES AND DERIVATIVES
Humberto Fernandez-Moran, Mitsuo Ohtsuki, and C. Hough *In its* Electron Microscopy in Microbiol. and Lunar Rock Analysis Dec. 1970 1 p Presented at the 7th Intern. Congr. on Electron Microscopy, Grenoble, France, 30 Aug.–5 Sep. 1970 (See N71-19311 08-14)
Avail: NTIS CSCL 06C

The most promising areas suitable for investigation with the high resolution, high voltage, and low temperature electron microscope and diffraction techniques are identified. These include studies of bacteria, algae, mitochondria, multi-enzyme complexes, and microspecimens of lunar rock. Computerized image enhancement and cryo-electron microscope development are also mentioned. N.E.N.

N71-19347# American Micromation Industries, Inc., Philadelphia, Pa.
EXPERIMENTAL BASIS FOR MAXIMUM ALLOWABLE LOAD (MAL) OF Pu 239 IN THE HUMAN ORGANISM, AND MAXIMUM ALLOWABLE CONCENTRATION (MAC) OF Pu 239 IN AIR AT WORK LOCATIONS [K EKSPERIMENTAL'NOMU OBOSNOVANIYU PREDEL'NO DOPUSTIMOI NAGRUZKI (PDN) PLUTONIYA-239 V ORGANIZME CHELOVEKA I PREDEL'NO DOPUSTIMOI KONTSENTRATSII (PDN) PLUTONIYA-239 V VOZDUKHE RABOCHIKH POMESHCHENII]
L. A. Buldakov et al Nov. 1970 32 p refs Transl. into ENGLISH from a Russian report Sponsored by AEC Prepared for ANL
(ANL-Trans-864) Avail: NTIS

Experimental data regarding the biological effect of plutonium-239 with various routes and rhythms of accumulation in the organism, as well as information regarding the behavior of the emitter in the organism and its microdistribution in the lungs, raises the question of the need for reexamining existing norms for MAL and MAC. The following recommendations are made: decrease the MAL of plutonium-239 in the organism for professional irradiation (soluble compounds) from 0.04 micro-Ci to 0.01 micro-Ci; decrease the MAL of plutonium-239 in the lungs from 0.016 micro-Ci to 0.0016 micro-Ci; decrease the MAC of plutonium-239 in the air at work locations from 2.10 to the −15th power Ci/1 to 5.10 to the −16th power Ci/1; establish a norm for maximum allowable accumulation of plutonium-239 in the human organism through the respiratory route at a value of 1.25 nCi/year or .3 nCi/quarter. Author (NSA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-18288# Commissariat a l'Energie Atomique, Chuscian (France). Centre de Production de Plutonium de Marcoule.
HUMAN FACTOR IN ACCIDENTS TO PERSONNEL IN THE NUCLEAR FIELD [LE FACTEUR HUMAIN DANS LES ACCIDENTS DU TRAVAIL SURVENUS DANS LE SECTEUR NUCLEAIRE]
1969 15 p refs In FRENCH Presented at Symp. on Educ. and Training of Workers in Radioprotection, Brussels
(CEA-CONF-1514; CONF-691211-1) Avail: AEC Depository Libraries

Accidents known to have occurred since the beginning of the nuclear era shows that to a very large extent their causes are of human origin: lack of technical knowledge of the material and method used; lack of theoretical knowledge of the nature of radiations and their biological effects; ignorance of elementary ideas on radiation shielding safety signalling; regulations concerning the use of artificial radioelements or X-ray generators; absence or poor functioning of detection instruments because of lack of maintenance; manipulations badly prepared and carried out; failure to comply with instructions or safety signals; forgetfulness or underestimation of danger, negligence, and inattention; voluntary disconnecting of safety devices; and etc. Author (NSA)

N71-18384# Whirlpool Corp., St. Joseph, Mich. Life Support Systems Group.
DEVICES FOR STORING AND DISPENSING REHYDRATABLE FOODS ABOARD A SPACE VEHICLE Final Report, Jan.–Sep. 1969
William T. Martin, John J. Symons, and Norman G. Roth Sep. 1970 29 p
(Contract F48109-69-C-0019)
(AD-715036; SAM-TR-70-58) Avail: NTIS CSCL 6/8

The feasibility of dispensing rehydratable food from bulk storage aboard a space vehicle was studied. Three candidate systems--Revolving Wheel, Butterfly Valve, and Gas Entrainment -- are described and analyzed. Author (GRA)

N71-18399*# Stanford Univ., Calif. Dept. of Applied Mechanics.
EXPERIMENTAL INVESTIGATION OF PLANAR MOTIONS OF A HUMAN BEING UNDER THE ACTION OF A BODY-FIXED THRUST
J. D. Yetteau and T. R. Kane Jan. 1971 109 p refs
(Grant NGR-05-020-209)
(NASA-CR-116799; TR-202) Avail: NTIS CSCL 05E

The feasibility of providing a weightless astronaut with a simple manuevering device by attaching a single thruster to one part of the body was investigated in a space operations simulator. The results show that man can perform well controlled planar motions when acted upon by a body-fixed thrust. F.O.S.

N71-18415# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A HYDRAULIC GRIP DYNAMOMETER Final Report, Oct. 1969–May 1970
Robert E. Van Patten and Michael Rubanstein Sep. 1970 20 p refs
(AD-715911; AMRL-TR-70-71) Avail: NTIS CSCL 6/12

A lightweight, compact grip dynamometer and its associated circuitry was developed for use in studies pertaining to the cardiovascular effects of sustained submaximal contractions and protection of aircrew men against the effects of elevated gravitational fields. Author (GRA)

N71-18697*# Environmental Research Associates, Essex, Md.
LUNAR SHELTER HABITABILITY EVALUATION
G. Samuel Mattingly, Harry L. Lests, Jr., and George M. Hay Feb. 1971 72 p ref
(Contract NAS1-8975-1)
(NASA-CR-111824) Avail: NTIS CSCL 06K

The results are reported of an investigation to determine the capability of pressure suited personnel to deploy lunar shelter/airlock structures, install mockup life support, power and miscellaneous equipment within and outside the shelter, and adequately utilize this equipment after installation. Information was obtained on: (1) dimensional requirements for lunar shelter interiors, hatches, and airlocks, (2) limitations imposed on lunar shelter design by pressure suited crewmen, (3) times associated with various work tasks, and (4) redesign recommendations for a lunar stay time extension module (STEM). Author

N71-18741# Human Factors Research, Inc., Goleta, Calif.
THE EFFECTS OF DISPLAY ALTERNATION ON MONITORING PERFORMANCE
Charles Abrams, C. H. Baker, and Donald N. Buckner Nov. 1970 26 p refs
(Contract Nonr-4120(00))
(AD-715777; Rept-750-14) Avail: NTIS CSCL 5/8

Target detection performance on a radar and sonar task was assessed as a function of time on watch for two display conditions. In one condition, the display alternated between radar and sonar sensors every four minutes; in the other condition, the radar and sonar sensors were displayed in a conventional, non-alternating, manner. Comparison of the data obtained under the alternating and non-alternating radar display conditions revealed no differences in performance between conditions but declines in detection performance as a function of time on watch were evident under both conditions. Detection performance on the sonar display benefited from the display alternation during the second half of the main watch. Author (GRA)

N71-18935*# TRW, Inc., Cleveland, Ohio.
AIRCREW OXYGEN SYSTEM DEVELOPMENT Final Summary Report
A. D. Babinsky, R. G. Huebscher, B. J. Kirsty, T. P. O'Grady and J. D. Powell Washington NASA Mar. 1971 51 p refs
(Contract NAS2-4444)
(NASA-CR-1741) Avail: NTIS CSCL 06K

An onboard aircrew oxygen generating system for tactical aircraft has been developed. Oxygen is generated by water electrolysis and carbon dioxide is removed from the rebreather by an electrochemical carbon dioxide concentrator. A description of the water electrolysis and the CO2 concentrator subsystems, a summary of the subsystem test results, a description of integrated aircrew breathing system, and a summary of the preflight, flight, and post-flight test data are included. Author

N71-19055# Joint Publications Research Service, Washington, D.C.
PROTECTION OF SPACESHIP CREW MEMBERS AGAINST RADIATION DAMAGE BY USE OF RADIOPROTECTANTS
P. P. Saksonov et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 21-24 refs (See N71-19051 08-04)
Avail: NTIS

General approaches to the radiation protection of spaceship crew members by the use of various drugs are discussed. Experimental data obtained on animals were extrapolated to humans. The validity of this extrapolation is confirmed by observations accumulated in the clinical use of radioprotectants during X-ray treatment. Author

N71-19075# Joint Publications Research Service, Washington, D.C.
PROBLEMS IN HUMAN LIFE SUPPORT IN SPACE
I. I. Gitelzon *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 129-132 Presented at 20th Congr. of the Intern. Astronaut. Federation, Mar Del Plata, Argentina, 5-10 Oct. 1969 (See N71-19051 08-04)
Avail: NTIS

Observations are given on the conference proceedings with emphasis on those papers concerning life support systems in space. E.C.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-18457# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
ON THE ANODIZED ALUMINUM HUMIDITY SENSOR Final Report, 1 Jul. 1967-30 Jun. 1970
Min-Nan Sze 30 Jun. 1970 297 p refs
(Contract F19628-67-C-0226)
(AD-715914; AFCRL-70-0395) Avail: NTIS CSCL 7/4

The objectives of the study was to understand: (1) the formation and the physical characteristics of an anodized aluminium film and (2) the sorption equilibrium and kinetics of water vapor on anodized aluminium. The results of a study of sorption equilibrium and kinetics of water vapor on anodized aluminium indicate that (1) the adsorption mechanism of water vapor on anodized aluminium film consists of monomolecular, multimolecular and condensation adsorption; (2) sorption hysteresis is evident if condensation occurs, otherwise sorption is reversible; (3) aging reduces the water vapor adsorption capacity of anodized aluminium and probably forms a hydroxide; (4) a small temperature coefficient on a relative humidity basis is observed; (5) reproducibility in sorption is excellent; (6) at low air velocities, external mass transfer plays an important role in the sorption rate; and (7) sorption rate depends on the slope of the adsorption isotherms. An analysis of response time was conducted from the standpoint of diffusion and sorption. In general, the slow response is associated with condensation absorption of water which seals off the pore, otherwise the sorption rate is very rapid (for 63% change). Author (GRA)

N71-18488# Northeastern Univ., Boston, Mass. Dept. of Physics.
MODIFIED POTASSIUM DIHYDROGEN PHOSPHATE (KDP) MODEL IN A STAGGERED FIELD
F. Y. Wu Jan. 1971 23 p refs
(Grants NSF GP-9041; NSF GP-25306)
(NUB-2045) Avail: Issuing Activity

The exact solution of the modified potassium dihydrogen phosphate model of a ferroelectric previously considered in a direct field only is now extended to include a staggered field. The thermodynamic properties are found to remain unchanged with the addition a staggered field; namely the specific heat vanishes below the transition temperature T sub c and diverges as (T - T sub c) to the -0.5 power above T sub c. Phase diagrams similar to those of an antiferroelectric in a direct field are obtained. Behaviors of polarizations in both direct and staggered fields are also discussed. Author

N71-18490*# Hercules Research Center, Wilmington, Del.
A STUDY OF THE MECHANISM OF CHEMICAL REACTIVITY OF NITROGEN TETROXIDE WITH TITANIUM ALLOY Final Report, 26 Jan. 1969-31 Mar. 1970
A. Z. Conner, J. F. G. Clarke, Jr., J. A. Gailey, A. A. Orr, and W. D. Stone 15 Jun. 1970 217 p refs
(Contract NAS8-30519)
(NASA-CR-116796; HRC-70-1) Avail: NTIS CSCL 07D

The interactions between liquid dinitrogen tetroxide (N2O4) and 6A1 4V titanium alloy that lead to stress corrosion cracking (SCC) were investigated. The study was focused on establishing the

relationships between the chemical composition of N2O4 systems and SCC behavior. The specific objectives (1) to develop a standard SCC test capable of evaluating the SCC behavior of various types of N2O4, (2) to develop qualitative and quantitative methods of analysis capable of determining significant compositional differences in various types of N2O4, (3) to identify that constituent or component of N2O4 that induces or enhances SCC in 6A1 4V Ti alloy, and (4) to establish the possible presence of SCC inhibitors in certain types of N2O4 and to determine the concentration levels that are critical to their inhibitory action. Author

N71-18535# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.

ROLE OF ACTIVE MODES IN UNIMOLECULAR REACTIONS. VOLUME 2: THERMAL DECOMPOSITION OF FLUOROFORM AND METHANE Technical Report, Jun. 1969–Jul. 1970

Roger L. Wilkins 15 Dec. 1970 23 p refs

(Contract F04701-70-C-0059)

(AD-715897; TR-0059(6240-20)-2-Vol-2; SAMSO-TR-70-418-Vol-2) Avail: NTIS CSCL 7/4

A recently developed model has been applied to the Rice-Ramsperger-Kassel-Marcus (RRKM) theory of unimolecular reactions to calculate rate constants for the thermal decomposition of fluoroform and methane. Unlike previous failures to determine the pressure dependence for the thermal decomposition of fluoroform and methane by means of the quantum statistical RRKM theory of unimolecular reactions, the new model correlates available experimental data for both fluoroform and methane. In addition, the new model predicts a pressure dependence for the thermal decomposition of methane in the second-order region at high pressures. The latter result suggests that further experiments are required to measure the pressure dependence of the unimolecular rate constants for the thermal decomposition of methane. Author (GRA)

N71-18554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.

MELTING POINTS OF METALLIC ELEMENTS AND SELECTED COMPOUNDS Technical Report, Dec. 1967–Dec. 1969

J. H. Charlesworth Oct. 1970 132 p refs

(AD-715908; AFML-TR-70-137) Avail: NTIS CSCL 7/2

A comprehensive literature survey of the published melting points of 168 chemicals including metallic elements, intermetallics, beryllides, borides, carbides, halides, nitrides, oxides, and sulfides was conducted. The melting points compiled are presented both in Kelvin and in degrees Fahrenheit. Original references were used whenever possible. Using various criteria, such as purity of sample, test method and equipment, instrumentation, etc., an evaluation of the data was made to determine best values. Only data actually found in the literature are reported (no calculated mean values) and those considered most reliable indicated by being boxed in. A few solid-to-solid transition points are also presented, and the melting points given are limited primarily to the congruent type. Author (GRA)

N71-18589# Bureau of Mines, College Park, Md. Metallurgy Research Center.

MATHEMATICAL SIMULATION OF A GAS-SOLID REACTION IN A PACKED BED: REACTION OF CO2 WITH COKE

Hillary W. St. Clair Washington Feb. 1971 31 p refs

(BM-RI-7476) Avail: Issuing Activity

An experimental method for determining parameters for the rate of reaction of CO2 with solid carbon is described. The method involves the simulation of a flow reactor by a mathematical model based on a hypothetical multistage reactor which permits calculation of the analyses of effluent gas and carbon consumed as functions of the flow rate and duration of the reaction. The technique is applied to experimental data on the reaction of coke with CO2 in fluidized-bed and fixed-bed flow reactors. Also, a method is described whereby two parameters may be determined simultaneously. It involves a reiterative procedure that finds the values of the parameters that minimize the sum of squares of deviation between calculated and observed analyses of the effluent gas. Author

N71-18842# National Research Council of Canada, Ottawa (Ontario).

KINETICS OF FORMATION OF ZINC DITHIONITE [KINETIKA OBRAZOVANIYA GIDROSULFITA TSINKA]

T. I. Kunin et al 1970 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), v. 8, no. 6, 1965 p 921–925

(NRC-TT-1435) Avail: NTIS

Formation of zinc dithionite was studied in a reaction vessel, in which sulphur dioxide diffused through a suspension of zinc dust in water. The reaction vessel was placed in a TS-15M thermostat, which made it possible to maintain the temperature within + or − 0.05 C. Because of the pronounced exothermic nature of the process, the temperature in the reaction vessel could be maintained only within + or − 2 to 3 C at high reaction rates, and within + or − 1 C at low rates. The samples taken from the vessel after intervals of time were analyzed for dithionite by the iodometric method. The number of revolutions of the mixer (700 rev./min) was determined in preliminary tests and was kept constant throughout the experiments. The pH of the suspension was measured with a glass electrode which was placed directly in the reaction vessel. The effects of temperature, and SO2 feed rate (duration of the process), on the process of formation of zinc dithionite were studied. Author

N71-18844# Scottish Research Reactor Centre, East Kilbride.

REPORT ON SESSION 1967/1968

H. W. Wilson Feb. 1969 24 p refs

(SRRC-29/69) Avail: NTIS

Research progress is reported on the following topics: radiation chemistry studies using mass spectroscopy, capture gamma ray analysis, neutron diffraction, beta heating, fission studies, activation analysis and tracer studies, isotope separation, nuclear medicine studies, isotope geology, and reactor operation and development. R.B.

N71-18886# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.

THERMAL OXIDATION OF POLYOLEFINS

B. R. Jadmicek, S. S. Stivala, and L. Reich (Picatinny Arsenal) Dec. 1970 28 p refs Submitted for publication

(Contract N00014-68-A-0131)

(AD-715430; TR-21) Avail: NTIS CSCL 7/4

The uncatalyzed autoxidation of films of polyolefins, such as atactic and isotactic polypropylene, and atactic and isotactic poly(butene-1) reported previously by the authors are reviewed in light of their recent work. Reaction temperatures varied from 100 to 150C and oxygen concentrations from 5 to 100% by volume. A general reaction scheme was suggested and kinetic expressions subsequently derived therefrom have been satisfactorily applied to account for experimental results. Linear relationships between a maximum rate and concentration of oxygen for both low and high concentrations were obtained. In the case of the catalyzed autoxidations (Co(III) acetylacetonate) the general reaction scheme was modified to take into account the presence of the catalyst. A correlation between catalytic activities of metal acetylacetonates (Co(III), Mn(III), Cr(III), Fe(III) and Cu(III)) and the oxidation-reduction potentials was established. Author (GRA)

N71-18930*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
TABULATED VALUES OF CAVITATION B-FACTOR FOR HELIUM, H2, N2, F2, O2, REFRIGERANT 114, AND H2O
J. Hord and R. O. Voth Feb. 1971 112 p refs
(NASA-Order C-39004B)
(NASA-CR-116821; NBS-TN-397) Avail: SOD $1.00; NTIS CSCL 07D

A brief history is given on the development of the B-factor concept and its application to the design of liquid pumps. Adaptation of the quasi-static vaporization model to the cavitation process is discussed; previous methods of computing B-factor are reviewed and a simplified, more precise computation, consistent with the quasi-static model, is established. Merits of the different computational techniques are discussed and two of the methods are graphically compared. The best available property data are used to compute B-factors for several fluids over a wide range of temperatures. The results are tabulated as reference data which are useful in the application of the B-factor concept to the prediction of performance in cavitating liquid pumps. Author

N71-18979# Bureau of Mines, Minneapolis, Minn. Metallurgy Research Center.
REMOVING SULFUR DIOXIDE BY CARBON MONOXIDE REDUCTION
L. A. Haas, T. H. McCormick, and S. E. Khalafalla Mar. 1971 21 p refs
(BM-RI-7483) Avail: Issuing Activity

The feasibility of removing sulfur dioxide by carbon monixide reduction in a fixed-bed catalytic reactor was investigated by the Bureau of Mines. The reduction rate of sulfur dioxide with carbon monoxide was significantly dependent upon the iron and alumina content of the mixed catalyst. Maximum catalytic activity was obtained with about 40 percent iron-alumina mixture with a nominal gas mixture of 10 percent carbon monoxide, 5 percent sulfur dioxide, and the balance nitrogen. The synergistic effect of this catalyst mixture was explained by a dual reaction site mechanism, with both iron and alumina augmenting their specific sites at their interparticle contacts. The catalytic activity also increased with decreasing catalvst pellet size. With 0.7-mm pellets, the entire pellet appeared to be catalytically active in a 2-gram catalyst bed. The apparent activation energy of the reaction was 18.3 kcal per mole in the temperature range of 350 to 600 C. Carbonyl sulfide was produced by the interaction of carbon monoixide and sulfur. The method appears feasible for removing SO2 from waste gas if the oxygen is removed prior to the catalytic SO2 reduction process. Author

N71-18980 Syracuse Univ., N.Y.
A MECHANISM FOR THE ALPHA RADIOLYSIS OF GASEOUS HYDROGEN SULFIDE
Rubye Mayette Prigmore Torrey (Ph.D. Thesis) 1969 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-1972

The Ra-226 alpha radiolysis of gaseous hydrogen sulfide, at 25, 50, 100 and 200 mm of mercury pressure and 30.0 deg. Celsius, was investigated. A mechanism for its decomposition into hydrogen gas and sulfur is proposed. The behavior of the ion yield, M/N(molecules of hydrogen gas produced per ion pair formed), as a function of field strength, X/P, was examined at the four pressures above for pure hydrogen sulfide, and at 200 mm for hydrogen sulfide mixed with various additives. The inert moderator, helium, was also used. The saturation-current method of measuring ion yields was the experimental technique used. The ion yield-field strength curve had the same shape at all pressures studied, which signifies that the same processes are important in this pressure range. At 25 mm, the ion yield values in the X/P range from zero to five are 22% higher than those in the same field strength range at the other pressures. These higher ion yield values can be attributed to fewer deactivating collisions involving energized hydrogen sulfide molecules. Dissert. Abstr.

N71-18982 Yale Univ., New Haven, Conn.
THE CONDUCTANCE OF MIXED STRONG ELECTROLYTES AT FINITE CONCENTRATIONS
Mou-shan Chen (Ph.D. Thesis) 1969 49 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-2706

The continuity equation is solved to give mu' sub ji, which is defined by the given equation. The equation for mu' sub ji together with the Poisson-Boltzmann equation then gives a differentail equation for psi' sub j, which is integrated to give the relaxation field of pure electrostatic terms to the order of clnc. Similarly, the contribution to the relaxation field from hydrodynamic terms is also evaluated. The electrophoresis effect is calculated by mu' sub ji and the first order approximation of psi' sub j given by Onsager and Fuoss. The effects of the relaxation field and electrophoresis are then combined to given the conductance equation to the order of clnc. Dissert. Abstr.

N71-18993 Akron Univ., Ohio.
CAVITATION IN ELASTOMERS
Dale Alva Tompkins (Ph.D. Thesis) 1968 258 p
Avail: Univ. Microfilms: HC $11.70/Microfilms $3.00 Order No. 70-1463

An experimental study of the formation and growth of gas bubbles in crosslinked elastomers is described. A critical condition for cavitation is found to hold in most cases: the gas supersaturation pressure must exceed 5E/6, where E is the Young modulus of the elastomer. Strain was found to reduce cavitation at less than 5E/6. The kinetics of cavity growth are shown to be in good accord with a simple diffusion-controlled growth relation for a variety of gases, elastomers, temperatures and pressures. The number of cavities depends strongly on the degree of supersaturation. This effect is primarily attributed to the initial presence of internal holes of a range of sizes; it is also influenced by kinetic factors. Dissert. Abstr.

N71-19026 Oklahoma Univ., Norman.
HYDROGEN BONDING EQUILIBRIA IN DILUTE SOLUTION. VAPOR PRESSURE AND VAPOR DENSITY STUDIES
Edwin Earl Tucker (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-2341

Thermodynamic data reported are descriptive of 1:1 complex formation between two proton donors, methanol and water, and the proton acceptor diethylamine both in the vapor phase and in three low vapor pressure organic solvents of varying reactivity. Energies and entropies of distribution of the individual proton donors and the acceptor between the vapor phase and each solvent are reported. Enthalpy and entropy values for water and methanol association in the three solvents have been obtained. On the basis of the description of methanol self-association in the three low vapor pressure solvents an association model for alcohols has been developed and is shown to be applicable for correlation of spectral data for alcohol solvent systems. Dissert. Abstr.

N71-19097# National Science Foundation, Washington, D.C.
THERMODIFFUSION OF CESIUM VAPORS IN HELIUM [TERMICHESKAYA DIFFUZIYA PAROV TSEZIYA V GELII]
K. M. Arefev et al 1970 16 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 11, no. 6, 1966 p 765-772 Prepared in cooperation with NBS
(TT-70-57072; DMDC-4682) Avail: NTIS CSCL 07D

The thermodiffusion of cesium vapors in helium was studied.

Diffusion coefficients and thermodiffusion ratios were calculated. Thermodiffusion flow in the case of condensation of cesium from a mixture with helium was investigated. Author (GRA)

N71-19112 Duke Univ., Durham, N.C.
LONG TERM RADIATION INDUCED CONDUCTIVITY IN POLYETHYLENE TEREPHTHALATE
Lewis Franklin Ballard (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-2141

Radiation induced conductivity (RIC) in polyethylene terephthalate (PET) is studied in amorphous and partially crystalline samples exposed to Co-60 gamma rays. Emphasis is placed on persistent RIC which exists for a long period of time after exposure. The drift mobility of holes in PET is observed by a pulsed photoconductivity technique. By the same method, the carrier mobility in dimethylterephthalate (DMT), a model compound for the PET polymer, is found for holes and for electrons. Significant reduction in the mobility after irradiation is observed. The primary source of the long term RIC which becomes significant at radiation doses above 1 million rads is concluded to be an increase in the carrier concentration. Dissert. Abstr.

N71-19116*# Louisiana State Univ., New Orleans. Dept. of Biology.
FATTY ACID ETHYL ESTERS OF RHIZOPUS ARRHIZUS. ETHYL ESTERS OF LONG-CHAIN FATTY ACIDS ARE REPORTED FOR RHIZOPUS ARRHIZUS
John L. Laseter and John D. Weete (Lunar Sci. Inst.) [1970] 11 p refs *Its* Lunar Sci. Inst. No. 12
(Contract NSR-09-051-001)
(NASA-CR-116886) Avail: NTIS CSCL 07C

Gas chromatographic and mass spectrometric analyses on selected lipid fractions revealed the presence of ethyl esters of long-chain fatty acids as biological products. Ethyl esters of oleic (17.0%), palmitic (1.3%), and stearic (1.3%) acids were detected. Both saturated and unsaturated ethyl esters contain pronounced mass spectral fragments at m/e = 88. Author

N71-19168*# Rice Univ., Houston, Tex. Dept. of Chemistry.
THE DIHALIDES OF GROUP 4B ELEMENTS
J. L. Margrave, K. G. Sharp, and P. W. Wilson [1971] 63 p refs
(Grant NGL-44-006-001)
(NASA-CR-116884) Avail: NTIS CSCL 07D

The chemistry of the dihalides of the Group 4B elements is discussed with respect to their different uses as reactive intermediates in liquid phase studies and as intermediates in gas phase reactions. Experiments have been designed that produce the dihalides in conditions that prevent their immediate reaction with other reagents in the system. This approach permits direct measurement of dihalide physical properties and chemistry. Author

N71-19238*# Rice Univ., Houston, Tex. Chemical Engineering Dept.
FERRITE SPINELS AS CATALYSTS IN THE OXIDATIVE DEHYDROGENATION OF BUTENES
W. Ronald Cares and Joe W. Hightower [1970] 32 p refs
(Grant NGL-44-006-001)
(NASA-CR-116882) Avail: NTIS CSCL 07D

Samples of cobalt and copper ferrite spinels were used as catalysts in oxidative dehydrogenation and ammoxidation reactions of mono-olefins to diolefins, aldehydes, and nitriles. Experimental procedures are described. Results of reactions in the circulation reactor system, deuterium exchange studies in trans-2-butene oxidation, and electrical conductivity studies of cobalt ferrite are analyzed. It is concluded that C-H bond cleavage is involved in the rate determining step and gaseous oxygen is needed for reactions with cobalt ferrite. J.A.M.

N71-19334# Nolit Publishing House, Belgrade (Yugoslavia).
BULLETIN OF THE CHEMICAL SOCIETY, BELGRADE. VOLUME 34, NO. 2-3-4, 1969
Aleksandar Despic, ed. 1969 149 p refs Transl. into ENGLISH from Glasnik Hem. Drustva, Beograd (Belgrade), v. 34, no. 2-3-4, 1969 Sponsored by Com. Dept. and NSF Prepared for Com. Dept. and NSF
(TT-69-51008/2-4) Avail: NTIS CSCL 07D

Contents: emission spectra of CuOH and CuOD; determination of hypochlorous acid dissociation constant; superstructure in the system bismuth-tellurium-selenium; austenite breakdown in high-manganese Hadfield steel; dynamic adsorption of organic vapors; carbon activity in fuel cell electrodes; polarization characteristics of lead dioxide electrode; solution of aluminum(III) fluoride; composition of the palladous thioglycolic complex; manganese chloride compounds with alkylpyridine hydrochlorides; synthesis of propanoic acids and their esters; preparation and purification of D-glucose 3-sulfate and D-glucose 6-sulfate; application of arc-excited Swan's bands in quantitative spectrochemical analysis; interferometric precipitation titration; the use of phthalic anhydride in the determination of various mixtures of amines; determination of amines mixtures blocking primary amines; argentometric determination of systems. GRA

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-18294# Computer Applications, Inc., New York. Systems Engineering Div.
MART PROGRAM, PHASE 1, RADIATION THEORY Quarterly Progress Report, Period Ending 31 Jan. 1970
V. Mangulis 31 Jan. 1970 27 p refs
(Contract N00024-69-C-1342)
(AD-714807; CAI-SED-7105-I-Q-3; QPR-3) Avail: NTIS CSCL 17/1

During the third quarter of MART Program, Phase I, some additional work on the effects of interstices in infinite arrays has been performed. Some further comments on analytical vs. numerical methods are offered. A few preliminary suggestions for work to be done during the next phase of the program are included. Author (GRA)

N71-18295# Computer Applications, Inc., New York. Systems Engineering Div.
MART PROGRAM, PHASE 1, RADIATION THEORY Quarterly Progress Report, Period Ending 30 Apr. 1970
V. Mangulis 30 Apr. 1970 24 p refs
(Contract N00024-69-C-1342)
(AD-714808; CAI-SED-7105-Q-4; QPR-4) Avail: NTIS CSCL 17/1

During the fourth quarter of the MART Program, the work on the effects of nonrigid interstices in infinite planar arrays has been continued, as outlined in Section II. A separate technical note on the subject has been released during the quarter. A literature search on the scattering of acoustic radiation by nonrigid baffles has been initiated. Author (GRA)

N71-18519# Royal Aircraft Establishment, Farnborough (England).
THE DESIGN AND DEVELOPMENT OF AN AIRCRAFT MOUNTING PRINTED-CIRCUIT SPIRAL AERIAL COVERING THE RANGE 200-800 MHz
D. P. L. May, G. F. Milne, and F. O. Baker Apr. 1970 41 p refs
(RAE-TR-70062) Copyright. Avail: NTIS

The measured characteristics of a right-hand circularly polarized unidirectional aerial, covering from 200 to 800 MHz in two octave-wide ranges, are given. The beam width and circularity are remarkably constant throughout the band, half power beam width being about 82 deg. Ellipticity is as low as 0.5 dB with a maximum of 3.0 dB at 800 MHz. The feed impedance is 50 ohms unbalanced and the gain is about 7 dB relative to a circular isotropic source. It is particularly suitable where projections beyond the aircraft hull are undesirable. Author (ESRO)

N71-18534# Air Force Cambridge Research Labs., Bedford, Mass.
A SURVEY OF SCINTILLATION DATA AND IT'S RELATIONSHIP TO SATELLITE COMMUNICATIONS
Jules Aarons Jan. 1970 119 p refs
(AD-715891; AFCRL-70-0053; AFCRL-SR-106) Avail: NTIS CSCL 17/2

In order to provide a state-of-the art survey of amplitude fluctuations produced by irregularities at F-layer heights in the ionosphere, a survey and review of scintillation phenomena was produced. The survey starts with a definition of scintillation index and a means of characterizing the effect of the amplitude fluctuations on transmissions from a satellite beacon. Various mechanisms proposed for the origin of the irregularity structure are reviewed in light of the observations. The translation of the geophysical information into engineering terms is made so that both depth of fade as a function of latitude and fading rate can be determined. These in turn are used to determine percentage of time scintillations. Characteristics of scintillation dictate modulation systems to be specified for communication and navigation systems employing synchronous satellite beacons at VHF and UHF. Specific problems are addressed. These include low angle or tropospheric scintillations, polar observations, and equatorial irregularities. Variations of scintillation index with magnetic latitude areas are given. Another atmospheric effect on satellite transmissions is discussed in the final chapter, that is, propagation delays of VHF waves produced by the time delay of radio waves traversing the ionosphere.
Author (GRA)

N71-18555# New Hampshire Univ., Durham. Antenna Systems Lab.
THE UNH/AFCRL METEOR TRAILS RADAR Final Report, 1 Mar. 1967–31 Aug. 1970
Albert D. Frost, Ronald R. Clark, Filson H. Glanz, and Pierre J. Catala 30 Sep. 1970 29 p refs
(Contract F19628-67-C-0230)
(AD-715929; ASL-70-E; AFCRL-70-0541) Avail: NTIS CSCL 17/9

A pulse radar system operating at 36.8 MHz was placed in operation in 1967 at the University of New Hampshire, Durham, N. H. for the measurement of wind speeds at altitudes between 80 and 120 km through observations of the drift in the ionization trails of meteors. Subsequent modifications were made to provide an offset Doppler channel for low velocity sensing. An echo direction finding capability of plus or minus 1 degree in elevation and azimuth was achieved through the development of a time-shared phase sequence interferometer. System calibration was carried out with the aid of a ground controlled beacon transmitter in satellite OV1-17. Author (GRA)

N71-18565*# National Aeronautics and Space Administration. Goddard Spaceflight Center, Greenbelt, Md.
NASA MINITRACK INTERFEROMETER REFRACTION CORRECTIONS
P. E. Schmid Washington Mar. 1971 36 p refs
(NASA-TN-D-5966; G-974) Avail: NTIS CSCL 17B

The influence of the earth's atmosphere upon Minitrack calibration and spacecraft tracking is reviewed. The study is aimed at providing the orbit computation engineer with a means of selecting those refraction correction procedures that will insure maximum orbit computation accuracy whenever an interferometer such as the Minitrack system is used. Author

N71-18577# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugdatensysteme und Telemetrie.
EXTRAPOLATION BASED ON WEIGHTED SAMPLES APPLIED TO DATA COMPRESSION [EXTRAPOLATION MIT BEWERTETEN STUETZSTELLEN ZUR NACHRICHTENREDUKTION]
Wolf Dieter Kabiersch Jul. 1970 66 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-49) Avail: NTIS; ZLDI Munich: 14,50 DM

Prediction based on two preceding samples multiplied by weighting coefficients is theoretically analyzed. The optimized weights in a rms sense approach the weights of polynomial predictors with increasing linear dependance of the samples. For Gaussian distributed samples the reduction factor is developed in a series expansion. An estimate of the reduction factor under given conditions shows that efficient reduction is possible for strong correlation. Author (ESRO)

N71-18833# Institute for Telecommunication Sciences, Boulder, Colo. Research Labs.
A SURFACE-WAVE TRANSMISSION LINE FOR VEHICULAR COMMUNICATIONS Final Technical Report
R. G. FitzGerrell, L. L. Haidle, and J. E. Partch Feb. 1970 146 p refs Sponsored by DOT
Avail: Issuing Activity

The low cost, excellent coupling characteristics, and ability to serve vehicles on two closely spaced guideways make the Goubau surface-wave transmission line an attractive solution to the high-speed ground transportation communications problem. Encouraging results were obtained experimentally with the 918-ft prototype line used in this study. Author

N71-18876 Illinois Univ., Urbana.
RADIATION FROM AN OPEN ENDED WAVEGUIDE INTO AN INHOMOGENEOUSLY FILLED SPACE
Richard John Kostelnicek (Ph.D. Thesis) 1969 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-902

The approach is to formulate expressions for the electromagnetic fields in terms of a discrete mode spectrum inside the waveguide and continuous mode spectra in the open-regions. Subsequent mode matching at the waveguide aperture plane and air-slab interfaces leads to an integral equation with certain boundary conditions. A solution of this equation allows the determination of the fields throughout the whole of space. However, this equation is not solved directly, but instead, an auxiliary integral equation is formed from the original equation by employing the known exact solution of the canonical problem, viz., radiation from an open-ended waveguide into free-space. Use of the auxiliary equation has the advantage that it may be solved exactly in an asymptotic sense. Dissert. Abstr.

N71-18877 California Univ., Los Angeles.
TOPICS IN ANTENNA PROBABILISTICS
James Edward Howard (Ph.D. Thesis) 1969 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-2218

The effect of spatiotemporal random errors on antenna performance is studied. The antenna pattern for any four-dimensional (spatiotemporal) antenna is derived through the use of multidimensional Fourier transforms. A complete second-order description, of the pattern—comprised of the mean, variance, and covariance functions—is then derived. The probability distribution function of the antenna pattern is bounded and estimated on the basis of this description and such added information as symmetry, boundedness, decomposability, etc. The probabilistics of the two most common quality criteria for antenna performance—maximum sidelobe level and directivity (gain)—are also studied. Dissert. Abstr.

N71-18881 California Univ., Los Angeles.
PROPAGATION OF ELECTROMAGNETIC WAVES IN A LONGITUDINALLY MAGNETIZED FERRITE FILLED ELLIPTICAL WAVEGUIDE
William Edward Salmond (Ph.D. Thesis) 1969 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-2257

The wave equations and boundary conditions are derived for a waveguide of arbitrary cross-sectional shape. It is shown that for an elliptical cross-section the characteristic equations for the propagation constants take the form of even and odd infinite determinants. The corresponding hybrid waves reduce to ordinary TE and TM modes as the applied field becomes infinite. Solutions of the characteristic equations are obtained for various values of applied field strength, saturation magnetization, and waveguide ellipticity. The existence of three types of cutoff conditions is demonstrated. Expressions for the transverse electric and magnetic fields are derived and the waves are shown to be elliptically polarized. Dissert. Abstr.

N71-18925 Southern Methodist Univ., Dallas, Tex.
A RANDOM SAMPLING APPROACH TO DIGITAL DETECTION
Arthur John Collmeyer (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms; HC $4.80/Microfilm $3.00 Order No. 70-1125

The capabilities and limitations of digital detection schemes based on random sampling are defined. A two-phased approach is adopted. In the design phase, efforts are directed toward the development of good digital detection schemes. These, along with the existing schemes, are then analyzed to determine performance characteristics. In each case, an attempt is made to define the relationship between data rate (normalized by the information bandwidth) and detection error. This trade-off analysis is performed for several values of the signal-to-noise ratio. On the basis of these results, some preliminary conclusions are drawn relative to the practicability of digital detection schemes featuring random sampling. Dissert. Abstr.

N71-18946 Syracuse Univ., N.Y.
MUTUAL COUPLING BETWEEN LOG-PERIODIC DIPOLE ANTENNAS
Robert H. Kyle (Ph.D.Thesis) 1969 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-1961

Numerical techniques are used for the analysis of mutual coupling in arrays of log-periodic dipole antennas. The analysis is formulated in terms of impedance and admittance matrices for the dipole and transmission line networks. Approximations are made to make the solution of an otherwise intractable problem practical with the existing generation of computers. Antenna patterns for the array are expressed in terms of the current incident on each log-periodic antenna. Calculations are carried out for systems of one, two and three log periodic antennas. Some conclusions are presented concerning the mutual coupling properties of small log-periodic arrays. Dissert. Abstr.

N71-18948# California Univ., Berkeley.
FACTORS INVOLVED IN APPLYING RATE DISTORTION THEORY TO IMAGE TRANSMISSION
David J. Sakrison [1971] 7 p refs
Avail: Issuing Activity

Image or picture transmissions over a noisy communications medium or over a noiseless digital channel are studied. In either case the channel is characterized by its information theoretical capacity so that transmission cannot occur with exact fidelity if the channel capacity is finite. Developed are encoding of modulation methods which minimize transmission distortion over a given channel, or minimize the required capacity for image transmission with a fixed acceptable level of distortion. Rate distortion theory in psychophysics of vision is used to examine meaningful measures of distortion in image transmission with partially known source statistics, as functions of a random field, in relation to isotropic random fields, and for rate increases due to line-by-line processing. G.G.

N71-18960 Denver Univ., Colo.
IDEAL SINGLE SIDEBAND MODULATION
Thomas William Clewes (Ph.D. Thesis) 1969 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-1923

Mathematical SSB modem models are developed applying direct and quadrature transform theory. Effects of introducing time delays in the phase shifting networks and the necessity of introducing the distinguished angular frequency m in the mathematical model are discussed. A definition of power eliminates need for the periodicity condition. Power contaminant ratios on the channels are compared with sine and cosine inputs, and an improved modem suitable for both sine and cosine inputs is developed. Results are obtained for contaminant comparison with channel filters included in the modem. Mathematical modem models which give transfer function improvement are presented. A degraded single channel USB modem is proposed and improved with feedback. Dissert. Abstr.

N71-18973# RAND Corp., Santa Monica, Calif.
SATELLITE SPACING AND FREQUENCY SHARING FOR COMMUNICATION AND BROADCAST SERVICES
John L. Hult and Edward E. Reinhart Dec. 1970 38 p refs
Submitted for publication
(P-4508) Avail: Issuing Activity

A general approach for the efficient use of satellite orbits and the radio frequency spectrum is discussed. The protection received signals, equipment capabilities, and pertinent systems consideratons are reviewed and the principal direct and scatter modes of interference are examined. It is concluded that careful coordination to achieve the full potential use of satellite orbits and spectrum can provide highly increased capacities. Intensive sharing of the spectrum by microwave and satellite relays to fixed terminals would not seriously limit either. Satellite down links for mobile and broadcast services can share the spectrum above VHF with terrestrial services without loss to either. Author

N71-19118 City Univ. of New York.
SEMICONDUCTOR TRAVELING WAVE INTERACTION
Joseph Stanley Nadan (Ph.D. Thesis) 1969 185 p
Avail: Univ. Microfilms: $8.40/Microfilm $3.00 Order No. 70-1107

The interaction between slow electromagnetic waves and drifting carriers in a semiconductor is studied considering two species of charge carrier, collision, recombination, cold circuit, and diffusion loss mechanisms. It is shown that for high resistivity materials the effect of the minority carrier may be neglected resulting in a dominant carrier dispersion equation. A perturbational solution to this equation is studied by root locus technique to reveal the

effects of the various parameters. The dispersion equation of a slow wave circuit suitable for use in studying the above interaction is developed taking into account the effects of a multi-layered medium. Experimental results verifying the above theory are presented. Dissert. Abstr.

N71-19119 Yale Univ., New Haven, Conn.
PASSIVE DETECTION AND TRACKING USING SURFACE SCATTERED SIGNALS
John Francis McDonald (Ph.D. Thesis) 1969 240 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 70-2766

Signals reflected from irregular time varying boundaries such as the sea surface undergo distortion which limits their detectability and useability for tracking. The properties of this distortion for correlator processing are herein related to the statistical constraints placed upon the time variation and irregularity of the boundary. Two propagation geometries are analysed. The first deals with the cross correlation of surface reflected and direct transmission paths, and the second with the cross correlation of surface scattered signals received at two different locations. This analysis assumes that the signal generated at the target and the background noise are both Gaussian random variables. Dissert. Abstr.

N71-19120 Denver Univ., Colo.
AN IMPROVED PHASELOCK LOOP DERIVED FROM IDEAL SINGLE SIDEBAND MODULATION
Robert Emmett Scott (Ph.D. Thesis) 1969 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 70-1921

The standard phaselock loop suffers from a low frequency restriction by the nature of its phase detector. An investigation was made with a view to removing this restriction. This investigation stressed the broad interrelationship between phaselock loop theory and ideal double sideband theory. The E-matrix phase detector evolved as a direct consequence of this relationship. It removed the low frequency restriction and the sine-cosine-matrix phaselock loop resulted. This phaselock loop is instantaneous and becomes, in the limit, an ideal frequency-modulation detector. For reasonable analysis and design requirements the delay factor can be replaced by a low order rational function. Thus first and second order systems with transport lag can be analyzed according to root-locus techniques. Dissert. Abstr.

N71-19152# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELECTROMAGNETIC SIGNAL PROPAGATION ALONG THE EARTH-IONOSPHERE WAVEGUIDE
V. V. Ivanov et al 28 Mar. 1969 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 10, no. 6, 1970 p 1010-1024
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Observed signal properties are interpreted as the result of signal propagation along a spherical waveguide formed by the earth's surface and the ionosphere. The signal record is connected with the geographic characteristics of the radiation source. The effect of rotation of the plane of polarization of the signal being propagated along a waveguide with an optically active wall is detected. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N71-18474*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPREHENSIVE COMPUTER PROGRAM FOR PREDICTING SOLAR CELL PERFORMANCE
J. P. Kirkpatrick, C. A. Lewis, and J. C. Gasper Washington Feb. 1971 104 p refs
(NASA-TM-X-2220; A-3178) Avail: NTIS CSCL 09B

A comprehensive computer program was developed to predict the performance of solar cells and complete arrays as a function of solar intensity. The program is unique in its capability to calculate the light-generated current of a single cell by integrating the solar or simulator spectrum with the following parameters as a function of wavelength: solar cell spectral response, filter transmission, and space radiation damage. The diode equation is then used to obtain the current-voltage characteristics and maximum power point. The prediction accuracy is enhanced over a wide range of light intensities by using a variable curve factor derived from experimental data in the diode equation. Array current-voltage curves may be calculated for combinations of series and parallel cell wiring arrangements. These curves reflect wiring and diode losses as well as angular orientation to the sun. The program is also useful in extrapolating available data, comparing experimental data taken with different energy sources, and correlating experimental and analytical predictions. Author

N71-18594* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONLINEAR ANALOG-TO-DIGITAL CONVERTER Patent
Robert M. Munoz, inventor (to NASA) Issued 6 Oct. 1970 (Filed 25 Mar. 1966) 6 p 340-347; Int. Cl. H03k13/04
(NASA-Case-XAC-04031; US-Patent-3,533,098; US-Patent-Appl-SN-538905) Avail: US Patent Office CSCL 09B

A continuous analog-to-digital converter with a parallel digital output, characterized by improved accuracy, especially in the low end of the scale, is described. Error is reduced by introducing an accurate nonlinearity in the feedback path. Instead of a linear feedback factor, the feedback voltage is varied in accordance with the function $N/1-N$, where N is the ratio of the digital output number to the number that represents full scale. Only two components are needed to produce the nonlinearity. Official Gazette of the U.S. Patent Office

N71-18595* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PULSE-TYPE MAGNETIC CORE MEMORY ELEMENT CIRCUIT WITH BLOCKING OSCILLATOR FEEDBACK Patent
Joseph C. Thornwall, inventor (to NASA) Issued 17 Mar. 1970 (Filed 13 Jan. 1966) 7 p Cl. 340-174; Int. Cl. G11b5/00
(NASA-Case-XGS-03303; US-Patent-3,501,752; US-Patent-Appl-SN-520838) Avail: US Patent Office CSCL 09B

A magnetic core memory element circuit includes a memory element having input windings and an output winding, a blocking oscillator connected between the output winding and one of the input windings, and a utilization device coupled to the blocking oscillator to receive an output. With this particular circuit configuration, the output from the magnetic core memory element can be applied to the utilization device and simultaneously be coupled back to the magnetic core memory element to automatically reset it to its original state, i.e., the magnetic core memory element can be interrogated without subsequent loss of information content. Official Gazette of the U.S. Patent Office

N71-18602* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RIPPLE ADD AND RIPPLE SUBTRACT BINARY COUNTERS Patent
David H. Schaefer and Rodger A. Cliff, inventors (to NASA) Issued

6 Oct. 1970 (Filed 30 Nov. 1966) 8 p Cl. 235-175; Int. Cl. G06f7/50
(NASA-Case-XGS-04766; US-Patent-3,532,866; US-Patent-Appl-SN-598120) Avail: US Patent Office CSCL 09B

A system is described for adding and subtracting binary numbers by adding or subtracting a number contained in one binary counter or register, to or from a number contained in a second counter. The output of each stage of the first counter is directly coupled to the input of its binary equivalent stage of the second counter. The outputs from the first counter's binary stages trigger the second counter's binary stages. If the second counter is a forward counter, addition is performed; if the second counter is a backward counter, subtraction is performed.
Official Gazette of the U.S. Patent Office

N71-18692* Motorola, Inc., Scottsdale, Ariz. Military Electronics Div.
DIGITAL FREQUENCY DISCRIMINATOR Patent
William J. Reid, inventor (to NASA) Issued 17 Mar. 1970 (Filed 19 Jun. 1967) 6 p Cl. 328-134; Int. Cl. H03b3/04; Int. Cl. H03k9/06 Sponsored by NASA
(NASA-Case-MFS-14322; US-Patent-3,501,701; US-Patent-Appl-SN-646934) Avail: US Patent Office CSCL 09B

A digital logic discriminator is described which has four integrated circuit chips, each consisting of a shift register stage and interconnected to form a divide function, exclusive OR function, phase shifting, and holding such that a single binary output signal is applied. When the binary signal is in a first state it indicates that one of the two input signals has a lower frequency than the other while in the second binary state the reverse is indicated.
Official Gazette of the U.S. Patent Office

N71-18693* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTING APPARATUS Patent
David H. Schaefer, inventor (to NASA) Issued 21 Apr. 1970 (Filed 6 Sep. 1966) 12 p Cl. 235-156; Int. Cl. G06f7/38
(NASA-Case-XGS-04765; US-Patent-3,508,036; US-Patent-Appl-SN-577545) Avail: US Patent Office CSCL 09B

A circuit for obtaining the sum of the squares of a group of numbers is described. The recognition of a unique relation between the binary representation of an integer to be squared and the binary representation of the difference between the square of that number and the square of the next previous number, makes possible a scheme for adding the number to be squared, which is stored in a first register, into selected higher order stages of a second register.
Official Gazette of the U.S. Patent Office

N71-18694* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAGNETIC CORE CURRENT STEERING COMMUTATOR Patent
Lawrence J. Zottarelli, inventor (to NASA) Issued 28 Apr. 1970 (Filed 19 Dec. 1967) 9 p Cl. 340-174; Int. Cl. G11c7/00, 19/00; Int. Cl. H04q1/52 Sponsored by NASA
(NASA-Case-NPO-10201; US-Patent-3,509,551; US-Patent-Appl-SN-691738) Avail: US Patent Office CSCL 09B

A switch for steering bipolar current pulses to any one of a group of current-utilizing memory words is described. Each word is associated with a pair of magnetic cores, and each core, within the pair is from a different core group. Initially, all the cores except one in the first group are reset. The cores are inductively coupled together with diodes so that a positive current pulse resets the previously set core of the first group. The reset core forward biases a diode, causing the current pulse to be steered to a word coupled to the particular reset core. Also, the steered current sets a core of the second group. When a negative pulse is supplied, the last set core in the second group is reset by the negative pulse, forward biasing a diode which causes the negative pulse to be steered through a word associated with the core of the second group. Also, a core in the first group is set to respond to a subsequently supplied positive pulse.
Official Gazette of the U.S. Patent Office

N71-18695# American Inst. of Physics, New York. Information Div.
SURVEY OF SCIENTIFIC-TECHNICAL TAPE SERVICES
Kenneth D. Carroll, comp. Sep. 1970 69 p refs Prepared in cooperation with Am. Soc. for Inform. Sci., Washington, D.C.
(Grant NSF GN-863)
(AID-ID-70-3; ASIS-SIG/SDI-2) Avail: NTIS; ERIC Clearing House on Library and Information Science, 1140 Connecticut Ave., N.W., Washington, D.C. 20006; Issuing Activity

The results of a survey of commercially available tape services, which can provide libraries and information centers with data bases of reference information on scientific and technical literature, are presented. The data presented are those obtained from the originators of the tapes, unless otherwise noted. More complete information regarding any tape may be obtained from the source noted for that tape.
Author

N71-18742# Michigan Univ., Ann Arbor.
THE CAMA OPERATING SYSTEM
L. J. Julyk Aug. 1970 72 p refs
(Contract DA-49-083-OSA-3050; ARPA Order 716)
(AD-715502; Rept-30) Avail: NTIS CSCL 9/2

The CAMA (Computer-Aided Mathematical Analysis) operating system is a program which controls the operation of an interactive processor. It is designed to operate in the environment of a large Central computer which polls a small graphics terminal computer for user-input. The CAMA system is designed to handle a number of different and independent operations, and to perform operations in a priority-based, multiply-queued environment. It is self-expendable by the use of its macro facilities.
Author (GRA)

N71-18751* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXCLUSIVE-Or DIGITAL LOGIC MODULE Patent
William G. Batte, inventor (to NASA) Issued 12 May 1970 (Filed 22 May 1967) 7 p Cl. 307-216; Int. Cl. H03k19/32
(NASA-Case-XLA-07732; US-Patent-3,512,009; US-Patent-Appl-SN-641441) Avail: US Patent Office CSCL 09B

A pair of inputs are connected through a biased diode circuit to the base-emitter junction of a transistor. When one of the inputs is true and the other is false, the transistor is switched to its opposite state. However, when both inputs are either true or false, the transistor is not switched. Additional circuitry is included for inverting, restoring, and amplifying the output from the transistor.
Official Gazette of the U.S. Patent Office

N71-18752* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STATIC INVERTERS WHICH SUM A PLURALITY OF WAVES Patent
Dorrance L. Anderson, Albert E. Willis, Carl E. Winkler, and John M. Gould, inventors (to NASA) Issued 21 Jul. 1970 (Filed 26 Jun. 1962) 11 p Cl. 321-5; Int. Cl. H02m7/52
(NASA-Case-XMF-00663; US-Patent-3,521,143; US-Patent-Appl-SN-205470) Avail: US Patent Office CSCL 09B

A static inverter with single or multiple phase output is described. The inverter is constructed with the rectangular waves being replaced by stepped waves, resulting in the substantial elimination of filter problems, reduction in weight, and improvement in reliability. A frequency standard is employed to generate a multiple of the desired inverter output frequency.
R.B.

N71-18815# Federal Aviation Agency, Washington, D.C.
SYSTEM DESCRIPTION OF THE FIELD TEST MODEL OF THE MODULAR ALPHA NUMERIC NON-TRACKING ATC SYSTEM (ARTS 2)
Nov. 1969 37 p
Avail: NTIS

The field test model of the automated radar terminal system (ARTS 2) is described. The system is suitable for application to radar terminal facilities that do not meet the requirements for the ARTS 3 system. Various aspects of the system are treated in separate sections and include: (1) a presentation on the system's background, environment, design objective, and expansion; (2) a description of the equipment and computer programs employed in the programmable ARTS 2 field evaluation model; (3) an operational description of the capability of the system when applied to existing facilities utilizing present radar and beacon subsystems; and (4) a section illustrating the system functions for typical arrival and departure control actions. D.L.G.

N71-18869 Auburn Univ., Ala.
THE REALIZATION OF GENERALIZED DIGITAL COMPENSATORS FOR SAMPLED-DATA SYSTEMS
Harry Hoyt Hull (Ph.D. Thesis) 1969 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-1707

The realization of the second-order digital compensator using integrated circuit components is presented as an interconnection of functional elements. The logical design of each functional element is detailed, and the interconnection of the elements is illustrated. An evaluation based on static and dynamic tests of the second-order compensator is made and both theoretical and experimental results are given. The computation time and the size of the compensator are examined. Next, the digital compensator was connected in a closed-loop analog simulation of the Saturn 5 Thrust Vector Control System and strip chart recorded plots indicating the system's closed-loop performance are shown. Author

N71-18889*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO PHASE HYDROGEN DENSITY MEASUREMENTS USING AN OPEN ENDED MICROWAVE CAVITY
Jerry Smetana and Norman C. Wenger Washington Mar. 1971 24 p refs
(NASA-TN-D-6212; E-5920) Avail: NTIS CSCL 09E

The density measurement of a two-phase mixture of liquid hydrogen with small uniformly distributed hydrogen gas bubbles is demonstrated using an open-ended microwave cavity. The theory of density measurements using microwave cavities is presented along with a detailed description of an experimental apparatus for generating a two-phase, liquid-gas mixture of known density. Experimental values for the measured and generated densities are presented and are shown to be in good agreement. Author

N71-18931*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
VISCEL. A GENERAL-PURPOSE COMPUTER PROGRAM FOR ANALYSIS OF LINEAR VISCOELASTIC STRUCTURES. VOLUME 1: USER'S MANUAL
F. A. Akyuz and E. Heer 15 Feb. 1971 27 p refs
(Contract NAS7-100)
(NASA-CR-116823; JPL-TM-33-466-Vol-1) Avail: NTIS CSCL 09B

VISCEL is an extension of the program ELAS, which was developed for the in-core solution of linear equilibrium problems of structural mechanics of limited size and with a minimum of computer time. The standard features and capabilities of ELAS have been preserved. The solution is obtained by means of the displacement method and the finite element technique together with the use of incremental time steps and a synchronized material property concept. The solution is obtained at the end of each time step as incremental and accumulative displacements and stresses. The recursive equations expressing the property of the material with memory have been incorporated in the computations. Also, a scheme which employs constant time steps in the logarithmic scale can be used to minimize the number of computations resulting from the accumulative effects of the material memory. The program is written in FORTRAN IV language for use in 32K IBM 7094 machines with a standard hardware configuration having a minimum of 15 system units. Author

N71-19022*# RAND Corp., Santa Monica, Calif.
MAPPING BY COMPUTER GRAPHICS: SATELLITE ANTENNA COVERAGE
N. C. Ostrander Oct. 1970 50 p
(Contract NASw-1952)
(NASA-CR-116814; R-525-NASA) Avail: NTIS CSCL 08B

The potential of directive satellite antennas has been investigated for the assessment of earth coverage attainable with a given satellite, antenna characteristics, and pointing direction. The coverage of geographic and political areas is often displayed and examined by superposing contours of marginal radiation intensity upon maps. An alternative to the construction of a large number of overlays is to construct a map projection (polar perspective) upon which a single overlay (representing a beam of given angular cross section) is valid over the entire map. The projection is virtually a picture of the earth as seen from the satellite, and each contemplated satellite position requires the preparation of a corresponding map. A number of such maps were constructed and proved to be highly useful in preparing the illustrative example of a worldwide television system. Described are some of the more common map types generated from a data tape of 10,000 points by computer. Author

N71-19029# Bureau of Mines, Denver, Colo. Automatic Data Processing Div.
COMPUTERIZED PROGRAMING OF RESPIRABLE DUST SAMPLING DATA
Donald P. Schlick and Kenneth R. Werner Mar. 1971 31 p
(BM-IC-8504) Avail: Issuing Activity

Coal worker's pneumoconiosis is caused by inhalation and retention of coal mine dust. Elimination of the disease requires reduction in the quantity of respirable dust to which each miner is exposed. The respirable dust sampling program requires frequent sampling of high-risk face workers and periodic sampling of other underground workers. Dust samples are collected by the coal mine operator, weighed and the results are processed by automatic data processing. The system employed to weigh the dust samples and to process and store the data is presented. Author

N71-19082*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GENERAL COMPUTER DATA PROCESSING SYSTEM: DOCUMENTATION OF THE ATS-5 GROUND STATION MAGNETOMETER PROGRAM
H. J. Gillis Nov. 1970 100 p
(NASA-TM-X-65457; X-645-70-458) Avail: NTIS CSCL 09B

A computer program capable of transforming and displaying specific time-dependent data recorded on an indefinitely large number of tape reels is discussed. The general data operations, the type of data processing accomplished, and the data source and tape format are described. The subroutines and their functions are itemized, and the program logic is explained. The various display outputs are illustrated. A concept-level plain language flow chart and a commented listing of the production program are presented. It is felt that the data operations accomplished by the system are of sufficiently general application that the system could be used to process other types of data with little modification. Author

N71-19117*# Computer Sciences Corp., Huntsville, Ala.
FAULT ISOLATION COMPUTER METHODS
Ricardo F. Garzia Washington NASA Feb. 1971 160 p refs
(Contract NAS8-18405)
(NASA-CR-1758; TR-1) Avail: NTIS CSCL 09B

Ten computer methods are presented for fault isolation; three of them employing two different techniques. In some cases computer applications are included, with some comments on the results of them. It is felt that some of the methods could be modified and improved to make them into practical tools. Others which assume ideal situations are impractical in a real environment. Author

N71-19288* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA COMPRESSION PROCESSOR Patent
Tage O. Anderson, inventor (to NASA) Issued 17 Mar. 1970 (Filed 19 Sep. 1967) 8 p Cl. 340-172.5; Int. Cl. G06f1/00 Sponsored by NASA
(NASA-Case-NPO-10068; US-Patent-3,501,750; US-Patent-Appl-SN-668969) Avail: US Patent Office CSCL 09B

A processor is described which is responsive to a sampled analog signal for selecting only those samples whose values differ from a previously selected sample by more than a predetermined amount or aperture value. The processor determines whether a new sample should be selected by initially comparing it with the last selected sample and then modifying the smaller of the two by adding the aperture value. The modified and unmodified samples are then compared and if the result is the same as the result of the first comparison, it indicates that the new sample differs from the one last selected by more than the aperture value and therefore should be selected. Official Gazette of the U.S. Patent Office

N71-19332# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
FAST FOURIER TRANSFORM PROGRAMS FOR THE EAI 640 DIGITAL COMPUTER
P. W. U. Graefe May 1970 36 p refs
(NRC-11747) Avail: NTIS

A set of programs for the computation of the Fast Fourier transform on an EAI 640 digital computer that were developed in the Mechanical Engineering Division of the National Research Council of Canada. In order to have a self-contained report on these Fast Fourier transform programs, a short summary of the properties of the discrete Fourier transform and the development of the Fast Fourier transform algorithm that is used in the digital computer programs for computing this transform, is also provided. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-18162# Tokyo Univ. (Japan). Inst. for Nuclear Study.
MODIFIED PEAKING STRIP METHOD FOR MEASUREMENTS OF SLOWLY VARYING LOW FIELD
Kuninori Endo and Hiroshi Sasaki Jul. 1970 17 p refs
(SJC-A-70-5) Avail: AEC Depository Libraries

A modified peaking strip method for the measurement of the dynamic low field has been developed. By superposing the high frequency field to the peaking strip, the pickup voltage becomes large and signal-to-noise ratio is improved remarkably. The apparatus was developed to measure the injection field of the proton synchrotron model magnet under dynamic excitation. Author (NSA)

N71-18217# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
GAMMA-RADIATION-INDUCED CURRENTS BETWEEN INSULATED DISSIMILAR ELECTRODES
R. B. Shields Jul. 1970 54 p refs Revised
(AECL-3564) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $2.00

The development of a detector for measuring reactor power by in-core gamma monitoring is described. The gamma monitor is based on gamma-induced current flow from two electrodes of different materials placed close together but insulated from each other. The current results from differences in the electron emission and collection properties of the two materials. Various electrode materials, geometries, and insulators were tested. NSA

N71-18243# Computer Applications, Inc., New York. Systems Engineering Div.
ON ARRAYS WITH NONRIGID INTERSTICES
V. Mangulis 4 Mar. 1970 43 p refs
(Contract N00024-69-C-1342)
(AD-714909; CAI/SED-7105-1-TN-2) Avail: NTIS CSCL 9/5

The radiation from an infinite phased planar array of rectangular pistons with nonrigid interstices is considered. Numerical calculations for exact equations are compared with a simple approximation, derived for small pistons close together. The comparisons show that the approximate expressions agree well with the exact results even for pistons of practical size if (1) the array is steered to an angle near broadside, (2) the interstitial impedance is not very low, and (3) the interstices occupy a small fraction of the total array area. Author (GRA)

N71-18253# Stanford Univ., Calif. Electronics Lab.
APERTURE SYNTHESIS FOR HF RADIO SIGNALS PROPAGATED VIA THE F LAYER OF THE IONOSPHERE
J. T. Lynch Sep. 1970 174 p refs
(Contract Nonr-225(64); ARPA Order 196)
(AD-714825; SU-SEL-70-066; TR-161) Avail: NTIS CSCL 9/5

A portable high-frequency (HF) radio aperture up to 70 km in length was synthesized by receiving ionospherically propagated signals in a DC-3 airplane. By thus moving a small antenna rapidly over a long distance, a narrow receiving beam width (high azimuthal resolution) was achieved. It is believed that the synthetic aperture described here is the first in the world developed for HF, although the concept has been used successfully at microwave frequencies. Author (GRA)

N71-18274# Thermo Electron Corp., Waltham, Mass.
THERMIONIC PERFORMANCE OF FLUORIDE CVD TUNGSTEN-NIOBIUM CONVERTER
F. Rufoh and D. Lieb Jun. 1970 69 p refs
(Contract AT(30-1)-4125)
(TE-4122-12-71; TE-4125-1) Avail: NTIS

Fluoride vapor-deposited tungsten has been shown to form a mechanically stable and easily fabricated thermionic emitter structure. Parametric data are obtained in a research, variable-spacing thermionic converter for a wide range of converter parameters. Attempts were also made to measure the cesiated work function of the electrodes. The transient effects observed showed that, unlike other materials, the emission characteristics of this emitter depend on its temperature history preceding the test. This dependence was attributed to the diffusion of an impurity element, possibly carbon, in the fluoride tungsten material to the emitter surface. It is known that the performance of fluoride tungsten emitters is considerably lower than that of other emitters (e.g., chloride tungsten). The present data indicate that the performance at low temperatures (less than 1900 K) would have been even lower if additives were not diffusing through the emitter. NSA

N71-18278# Thermo Electron Corp., Waltham, Mass.
PERFORMANCE REPRODUCIBILITY OF CYLINDRICAL DIODES WITH CVD FLUORIDE TUNGSTEN-NIOBIUM ELECTRODES
B. Gunther and P. Teagan Jun. 1970 50 p refs
(Contract AT(30-1)-4125)
(TEE-4125-3; TE-4122-4-71) Avail: NTIS

Cylindrical diodes with CVD fluoride tungsten emitters and niobium collectors tested and compared at common output current densities and cesium reservoir temperatures, such as may be present in a string of series-connected modules with a common cesium reservoir. The average performance of the converter was established and variations in performance of the individu converters from this average were quantified by a standard deviation. After the performance of each of the converters was established, they were operated under steady state conditions for 200 hours. The converters were then retested to determine the extent of possible short term changes in performance of individual converters and to what extent such changes in individual diode performance affected the average performance and the standard deviation. NSA

N71-18302# European Organization for Nuclear Research, Geneva (Switzerland).
TWO TRIPLE TWOFOLD GATED COINCIDENCE UNITS
F. Nanni and H. Verweij 15 Sep. 1970 26 p refs
(CERN-70-25) Avail: AEC Depository Libraries

Two coincidence units, types N6235 and N6237, are described. They both contain three independent twofold channels which can be gated by one common signal. They have been designed to operate with standard NIM signal levels (800 mV = '1', 0 mV = '0'). The two units have identical input AND-gates and gate circuitry, but they have different output facilities. The type N6235 has an output shaper and provides output signals of standard width (8.5 nsec). The type N6237 delivers output signals that have a width equal to the time overlap of the input signals. The minimum resolving time of the instruments is < or = to 1.5 nsec and the minimum gate width < or = to 2.5 nsec. The units are part of the CERN-NIM compatible nucleonic instrument range. Author (NSA)

N71-18319# Thermo Electron Corp., Waltham, Mass.
EMITTER TEMPERATURE DEPENDENCE OF LOWER MODE CURRENT
B. Gunther Jul. 1970 24 p refs
(Contract AT(30-1)-4125)
(TEE-4125-4; TE-4137-27-71) Avail: NTIS

Measurement of the apparent saturation current in the extinguished mode was suggested as a means of determining the emitter temperature. Data obtained from two converters with substantially different emitters ((110) and (100) tungsten) were in good agreement, showing that the emitter work function does not influence the deduced emitter temperature (within 25 K). Ignition current was essentially independent of collector temperature and, therefore, of collector work function, and was an inverse function of interelectrode spacings. It was found, however, that the ignition current is a linear function of emitter temperature. This is in contrast with the theoretical model which is the basis for predicting an exponential relation with inverse temperature. This difference corresponds to an error of 50 K in emitter temperature determinations. NSA

N71-18403# Scientific Research Atomic Reactor Inst., Melekess (USSR).
CONSTANT BASE LINE RESTORER AND OVERLAPPING REJECTING CIRCUIT FOR HIGH-PRECISION AMPLITUDE SPECTROMETERS WITH RC-CR FORMATION
V. B. Ivanov, N. N. Reshetov, and V. I. Shipilov 1970 23 p refs In RUSSIAN
(SRARI-P-67) Avail: AEC Depository Libraries

Modernized base line restorer and overlapping distorted pulse rejecting circuits are described allowing amplitude measurements with semiconductor detectors at input rates up to 10,000 pps with calibration scale stabilization and resolution deterioration by at most 0.5 to 0.7 keV as compared to the low rate results. Author (NSA)

N71-18448# Harry Diamond Labs., Washington, D.C.
RADIATION FROM A WIRE IN DIELECTRIC MATERIAL OVER A CONDUCTING GROUND PLANE
Clyde A. Morrison and Donald E. Wortman Aug. 1970 33 p refs
(AD-715357; HDL-TR-1525) Avail: NTIS CSCL 20/14

The electromagnetic radiation from an infinitely long wire imbedded in a dielectric layer over a conducting plane was calculated. The current was assumed to be constant along the length of the wire and to vary as e to the −i omega t power. A completely rigorous solution is given in integral form; the integrals were evaluated for small thicknesses, T, of the dielectric layer. It is shown that for thin layers the far field can be approximated by an effective current. The energy loss in the dielectric slab, the radiation resistance, and the directivity were also calculated using the thin layer approximation with a complex dielectric constant. Then the radiation resistance for arbitrary thickness and arbitrary complex dielectric constant was calculated. Author (GRA)

N71-18530# Naval Postgraduate School, Monterey, Calif.
ON THE REDUCTION OF CIRCUIT EQUATIONS FOR NUMERICAL INTEGRATION
Vernon Travis Barnes (M.S. Thesis) Apr. 1970 63 p refs
(AD-715648) Avail: NTIS CSCL 9/5

The reduction of circuit equations to normal form for numerical integration is considered for the general circuit where excess reactive elements, all types of linearly dependent sources, and nonlinear dissipative and reactive elements are present. For the linear circuit, necessary and sufficient conditions for the existence of numerical solutions are considered and stated. For the nonlinear circuit, reduction to normal form is not always possible. Numerical solution is shown to be simplified if certain a priori conditions are satisfied in formulating the original circuit equations. A new systematic reduction procedure is presented for obtaining the normal form equations. This procedure is also extended to a new procedure for obtaining transfer and immittance functions of the linear circuit from a proper tree formulation. Author (GRA)

N71-18531# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DEVELOPMENT OF A UHF TELEMETRY SYSTEM FOR PROJECTILES
Victor W. Richard Sep. 1970 103 p refs
(AD-715395; BRL-1486) Avail: NTIS CSCL 9/6

A UHF (1520 MHz) telemetry system for use with high altitude, gun-launched research probes and standard spinning shells is described. The major components of the projectile telemeter are designed as cylindrical modular plug-in units in order to meet a variety of instrumentation requirements for gun probe experiments and in-flight projectile performance monitoring. The special, ruggedized components and the techniques for pre-flight high acceleration testing are described. The components described include: broadband, omnidirectional antennas for front and rear mounting on a projectile; a high gain, all polarization, fan beam receiving antenna; highly stabilized, high efficiency UHF transmitters; miniaturized voltage controlled oscillators; 8 and 16 channel commutators; button cell battery packs; and modular assembly cases. The UHF telemetry receiving and recording station and the antenna radiation pattern and efficiency measurement facilities are also described. The physical and electrical characteristics of the

components of the telemetry system are presented along with laboratory test data and field performance data obtained from standard 155 mm spinning projectile rounds fired between August 1968 and September 1969. Author (GRA)

N71-18598* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RANGING SYSTEM Patent
Tage O. Anderson, inventor (to NASA) Issued 27 May 1969 (Filed 9 Nov. 1967) 8 p Cl. 343-13; Int. Cl. G01s9/06, 9/23, 9/24
Sponsored by NASA
(NASA-Case-NPO-10066; US-Patent-3,447,155; US-Patent-Appl-SN-681693) Avail: US Patent Office CSCL 09C

A system for determining the range to a distant object such as a space probe is described. The time between sending a pseudorandom code and receiving it back from the object is measured. A counter is connected to the transmitter code generator for converting the pseudorandom code to a number at every instant, and a second counter is connected to the receiver for converting the received code into a second number at every instant. A circuit is provided for comparing the numbers counted by the first and second counters to indicate the range. Official Gazette of the U.S. Patent Office

N71-18599* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SAFE-ARM INITIATOR Patent
Loyd C. Parker, inventor (to NASA) Issued 17 Mar. 1970 (Filed 17 May 1968) 8 p Cl. 102-70.2; Int. Cl. F42c13/08
(NASA-Case-LAR-10372; US-Patent-3,500,747; US-Patent-Appl-SN-730162) Avail: US Patent Office CSCL 09E

An electroexplosive initiator is described which incorporates the safety advantages of electromechanical safe-arm fuze systems in a standard weight and size unit. A charge of electric current is passed to electromagnetic rotor drive coils and electromagnets causing rotation of an out-of-line ignition bead or primary charge in the rotor. In the second position the primary charge is in-line with an explosive output charge. A second electric charge is passed to the ignition bead through internal contacts, causing sufficient heat to be generated by the bridge wire to ignite the ignition bead and initiator output charge. The unit has the functioning speed of a relay, and the construction enables thorough testing to be performed inexpensively. N.E.N.

N71-18600* Motorola, Inc., Scottsdale, Ariz.
SEALED CABINETRY Patent
Robert Samson, inventor (to NASA) Issued 3 Jun. 1969 (Filed 22 May 1967) 4 p Cl. 312-296; Int. Cl. A47b96/00, 88/20
Sponsored by NASA Prepared in cooperation with Grumman Aircraft Eng. Corp.
(NASA-Case-MSC-12168-1; US-Patent-3,447,850; US-Patent-Appl-SN-640154) Avail: US Patent Office CSCL 09E

A cabinet sealed against electromagnetic radiation is described. It has several drawers with spring tensioned drawer fronts which float with respect to the drawer frame, permitting the drawer front to seal against a deformable electromagnetic radiation sealing strip. Two adjacent drawer fronts may share a common sealing strip without leakage. Official Gazette of the U.S. Patent Office

N71-18617# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
ROTATING TRANSFORMER FOR CONTACTLESS ENERGY TRANSFER [TRANSFORMATEUR TOURNANT POUR TRANSFER D'ENERGIE SANS CONTACT MECANIQUE]
P. Joly 20 Oct. 1970 31 p In FRENCH
(LRBA-NT-46/70/SET/EL) Avail: NTIS

A preliminary design study has been carried out of a rotating transformer which can feed energy to a rotating body supported on magnetic bearings without contacts. The design led to a transformer, weighing 2 kg, fed by a 400 Hz current, transferring 600 W with an efficiency of 90%. For this power the destabilizing forces have a peak value of 1 N/micron and an induction of 0.8 W/sq m. ESRO

N71-18702*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TERMINATED CAPACITOR DISCHARGE FIRING OF ELECTROEXPLOSIVE DEVICES
L. A. Rosenthal (Rutgers Univ., N.J.) and V. J. Menichelli 15 Feb. 1971 11 p refs
(Contract NAS7-100)
(NASA-CR-116792; JPL-TR-32-1521) Avail: NTIS CSCL 09E

A simple capacitor discharge system for determining firing energy parameters by terminating the discharge of energy into an insensitive electroexplosive device is described. The system provides exponential pulses terminated at an adjustable width. Development technique and testing are discussed. Author

N71-18720* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLEXIBLE BLADE ANTENNA Patent
Jefferson F. Lindsey, III and Gareth H. Nason, inventors (to NASA) Issued 28 Apr. 1970 (Filed 30 Sep. 1968) 5 p Cl. 343-718; Int. Cl. H01Q1/12
(NASA-Case-MSC-12101; US-Patent-3,509,570; US-Patent-Appl-SN-763705) Avail: US Patent Office CSCL 09E

A flexible monopole antenna exhibiting a broad bandwidth characteristic and low voltage standing wave ratio over a selected frequency range is described. The flexible, resilient metallic blade is perpendicularly mounted from the surface of a solid dielectric material held in a metallic cup with the cup in turn being mounted in a flat metallic plate. A metallic shielded electrical conductor extends into the cup and through the dielectric material with the central conductor being electrically connected to the blade and the shield being electrically connected to the cup. The surface of the dielectric material is depressed to permit the blade to be bent flat and the blade is curved laterally to prevent it from kinking when bent and to increase its rigidity when erect. Official Gazette of the U.S. Patent Office

N71-18721* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
VOLTAGE TUNABLE GUNN-TYPE MICROWAVE GENERATOR Patent
Wilhelm Rindner and Harold Roth, inventors (to NASA) Issued 28 Apr. 1970 (Filed 2 Jun. 1967) 5 p Cl. 331-107; Int. Cl. H03b7/14, 11/10, 15/00
(NASA-Case-XER-07894; US-Patent-3,509,491; US-Patent-Appl-SN-644444) Avail: US Patent Office CSCL 09E

In one embodiment, a Gunn effect semiconductor chip having a varying cross sectional area is mounted between a pair of contacts. An electric field gradient exists along the current axis of the chip when a voltage is applied to the contacts. This electric field in combination with the variation in cross sectional area causes the generated frequency to vary in accordance with the applied voltage when the voltage is above the critical Gunn level for a portion of the current axis. A variation in the applied voltage varies the length of the portion of the field above the threshold level to vary the frequency of the output signal. In an alternate embodiment, the electric field gradient is created by non-uniform doping of the semiconductor block. Official Gazette of the U.S. Patent Office

N71-18830* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THERMAL DETECTOR OF ELECTROMAGNETIC ENERGY BY MEANS OF A VIBRATING ELECTRODE Patent

John Dimeff, inventor (to NASA) Issued 21 Apr. 1970 (Filed 11 Mar. 1968) 5 p Cl. 250-83; Int. Cl. G01t1/16
(NASA-Case-XAC-10768; US-Patent-3,508,053;
US-Patent-Appl-SN-711970) Avail: US Patent Office CSCL 09E

A thermal detector of electromagnetic energy containing a vibrating ribbon which is periodically displaced as a result of periodic heating by electromagnetic energy is described. A chopping wheel is provided to periodically attenuate any electromagnetic energy which may be incident on the displacement member. A fixed electrode is capacitively coupled to the displacement structure, and the amplitude of the periodic displacement is sensed by detecting the amplitude of the resulting changes in capacitance between the displacement structure and the fixed electrode. An automatic frequency control system responsive to the amplitude of the periodic displacement of the displacement structure stabilizes the attenuation frequency of the chopping wheel.
Official Gazette of the U.S. Patent Office

N71-18843* Stanford Research Inst., Menlo Park, Calif.
AUTOMATIC FAULT CORRECTION SYSTEM FOR PARALLEL SIGNAL CHANNELS Patent
Jacob Goldberg, inventor (to NASA) Issued 17 Mar. 1970 (Filed 4 Nov. 1965) 10 p Cl. 340-146.1; Int. Cl. G06f11/00; Int. Cl. G08b29/00 Sponsored by NASA Prepared for JPL
(NASA-Case-XNP-3263; US-Patent-3,501,743;
US-Patent-Appl-SN-506908) Avail: US Patent Office CSCL 09E

A system for automatic correction of signal errors in binary signal circuitry is depicted. It contains plurality of signal channels, each with a failure-susceptible element, interconnected to correct for the failure of any one of the elements. The input signals of two different channels are transmitted through each failure-susceptible element during two different cycles of operation. The transmitted signals are supplied to majority circuits. Each majority circuit, associated with a different channel, provides a signal corresponding to its channel's input signal as long as not more than one failure-susceptible element fails.
Official Gazette of the U.S. Patent Office

N71-18858# National Research Council of Canada, Ottawa (Ontario).
ELECTRICAL CHARACTERISTICS OF A DISCHARGE IN A HOLLOW CATHODE IN NEON [OB ELEKTRICHESKIKH KHARAKTERISTIKAKH RAZRYADA V POLOM KATODE V NEONE]
V. P. Gofmeister et al 1970 7 p refs Transl. into ENGLISH from Revue Romaine Phys. (Bucharest), v. 13, no. 1, 1968 p 19–24
(NRC-TT-1437) Avail: NTIS

Research was conducted aimed at extending the measurements made in a previous study, of the electrical and optical characteristics of a discharge in a hollow cathode in helium, to the case of the discharge in neon, and to show that these properties depend less on the kind of gas than on the electrical conditions of the cathode. The measurements were carried out at neon pressures of 0.5, 1, 2, and 5 mm Hg, and at current ratings of 20, 30, 50, and 100 ma. The results are presented graphically and illustrate the axial and radial course of the potential, the concentration of electrons, and the energy distribution function of the electrons. Author

N71-18891 Tennessee Univ., Knoxville.
THE LOADING EFFECTS DUE TO INPUT AND OUTPUT RESISTANCES OF INDIVIDUAL TRANSISTORS IN DISTRIBUTED AMPLIFIERS
Tom F. Cheek, Jr. (Ph.D. Thesis) 1969 246 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 70-2099

After an examination of the basic philosophy of distributed amplication to illustrate the attractive principle of additive amplification, an extensive review of vacuum-tube and transistor distributed amplifiers are presented. Important methods of analysis and synthesis are reviewed. Previous methods of analysis were highly ineffective in representing accurately the terminal properties of a given transistor section configuration. Consequently, a procedure using short-circuit equivalent transistor parameters and computer-aided design techniques was developed to obtain realistic data on the terminal properties of these circuits. Since loading effects are a major limitation in the operation of transistorized distributed amplifiers, an original analysis was developed for two transistor distributed amplifiers. This analysis was used to determine the magnitude of the effects which resistive loading has on the performance of these amplifiers. Furthermore, the development indicated the extent to which these dissipative elements could be present before the operation was seriously altered.
Dissert. Abstr.

N71-18938 Stanford Univ., Calif.
AN EXPERIMENTAL INVESTIGATION OF WAVE PROPAGATION IN SEMICONDUCTORS
Barry Ernest Burke (Ph.D. Thesis) 1969 162 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-1505

Measurements of two different types of radio frequency waves propagating through a medium of free carriers in a semiconductor are reported. The first type of wave is the so-called helicon wave which can propagate through an extrinsic semiconductor parallel to a magnetic field. This wave is circularly polarized with field vectors rotating in the same direction as the cyclotron gyration of the carriers. The second type of wave is a carrier wave and exists only when the free carriers in a semiconductor have a steady drift velocity resulting from an electric field applied to the crystal. This type of wave is the solid state counterpart of space charge waves observed on electron beams, and consists of spatially periodic variations in the carrier density moving at a velocity near that of the carrier drift velocity. Dissert. Abstr.

N71-19122*# General Electric Co., Pittsfield, Mass.
MEASUREMENTS AND ANALYSIS OF LIGHTNING-INDUCED VOLTAGES IN AIRCRAFT ELECTRICAL CIRCUITS
K. J. Lloyd, J. A. Plumer, and L. C. Walko Washington NASA Feb. 1971 170 p refs
(Contract NAS3-12019)
(NASA-CR-1744; HVL-69-161) Avail: NTIS CSCL 09E

An experimental investigation of voltages induced by lightning in aircraft electrical circuits is described. An extensive series of measurements was made of voltages induced in circuits within a metallic aircraft wing by full-scale simulated lightning currents flowing through its skin and structure. The measured data were mathematically analyzed to enable determination of voltages across load impedances to which the circuits might be connected elsewhere in the aircraft. Relationships between induced voltages and lightning current, wing structure, and circuit parameters were determined. Induced voltages of magnitudes likely to cause damage or interference with avionics were measured. Author

N71-19172# Weapons Research Establishment, Salisbury (Australia).
A COMPUTER PROGRAM FOR DESIGN OF LOW PASS FILTERS WITH UNIFORM OR SEMIUNIFORM DISSIPATION
G. R. Hasck May 1970 69 p refs
(WRE-TN-ED-193) Avail: NTIS

The theory used in developing a computer program for the design of low-pass filters is described. The program will design passive low-pass ladder filters with prescribed attenuation peak positions and equal ripple pass-band behavior. Provisions are made

for predistortion and extreme (zero or infinite) termination at one end, and these aspects are described in detail. Author

N71-19223*# Martin Marietta Corp., Denver, Colo.
AUTOMATIC TEST EQUIPMENT FOR ELECTRONIC COMPONENTS. VOLUME 1: SUMMARY REPORT
William A. Heffner Washington NASA Mar. 1971 36 p (Contract NAS12-2045)
(NASA-CR-1754; MCR-69-520-Vol-1) Avail: NTIS CSCL 09E

The significant results of a study conducted to define the requirements for an advanced test system for discrete, integrated, and experimental electronic components are reported. A cost-effectiveness analysis of the system application was also performed. The primary focus has been on technology changes and future trends. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N71-18414# Toulouse Univ. (France). Faculte des Sciences.
MATHEMATICAL MODEL OF THE MOS TRANSISTOR SUBJECTED TO HIGH ENERGY RADIATION [MODELE MATHEMATIQUE DU TRANSISTOR M.O.S. SOUMIS AUX RAYONNEMENTS DE GRANDE ENERGIE]
Jean-Louis Giraud (Ph.D. Thesis) 1970 113 p refs In FRENCH
(NP-18443) Avail: AEC Depository Libraries

A simple mathematical model was established representing the electronic processes taking place in MOS transistors; the possibility of programming the calculation was taken into account. The physical phenomena induced by the irradiation of the device were then considered in detail, in particular the threshold potential and the variation of the mobility of the charge carriers in the channel. The radiations used were Co-60 gamma rays, 14 MeV neutrons, 600 MeV protons and 4.5 and 13 MeV beta particles. An expression was derived for the degradation undergone, which was used to adapt the already established model to the case of an irradiated device. The various radiations used enabled the general case of radiation interaction with the material to be better understood. Author (NSA)

N71-18491*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN AND GLOBAL ANALYSIS OF SPACECRAFT ATTITUDE CONTROL SYSTEMS
George Meyer Washington Mar. 1971 51 p refs
(NASA-TR-R-361; A-3526) Avail: NTIS CSCL 22B

A general procedure for the design and analysis of three-axis, large angle attitude control systems has been developed. Properties of three-dimensional rotations are used to formulate a model of such systems. The model is general in that it is based on those properties which are common to all attitude control systems, rather than on special properties of particular components. Numerical values are assigned to attitude error by means of error functions. These functions are used to construct asymptotically stable control laws. The overall (global) behavior of the system is characterized by the envelope of all time histories of attitude error generated by every possible combination of initial condition, target attitude motion, and disturbance. A method for computing upper bounds on the response envelope is presented. Applications of this method indicate that it provides a useful alternative to Liapunov analysis for the determination of system stability, responsiveness, and sensitivity to disturbances, parameter variations, and target attitude motion. Author

N71-18582# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
IMPURITY BAND CONDUCTION IN SILICON [CONDUCTIVITE DUE A UNE BANDE D'IMPURETES DANS LE SILICIUM]
J. F. Roux and R. Schuttler Sep. 1970 32 p refs In FRENCH; ENGLISH summary
(ONERA-DERTS-NT-02-17) Avail: NTIS

It is shown that conductivity and Hall effect measurements in heavily phosphorus doped and aluminum compensated n-type silicon can be explained by introducing a second energy band in addition to the conduction band. In this model more than 10 to the 18th power impurities/cu cm create a true impurity band whose states have only pseudo momentum. From theoretical models the pseudo mobility of carriers is extracted as experimentally reasonable quantity. An elaborated nonlinear least squares fitting is used for unfolding the experimental data. This sample model is in good agreement with experiment and theory. Author (ESRO)

N71-18635*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARISON OF METHODS FOR IDENTIFYING PILOT DESCRIBING FUNCTIONS FROM CLOSED-LOOP OPERATING RECORDS
Rodney C. Wingrove Washington Mar. 1971 43 p refs
(NASA-TN-D-6235; A-3578) Avail: NTIS CSCL 09C

The relationship between the pilot's input and output when he performs routing tracking tasks while controlling a system with dynamics approximating those of an airplane is studied. The three different identification methods used to compare the amount of bias error present are: the parameter model, orthogonal filters, and impulse-response techniques. The amount of bias error depends upon the assumed system model. The bias error is reduced when the model used in the identification method has the same form as that of the simulated system. The parameter model method incorporates such a restricted model and consistently has the minimum bias error. The orthogonal filters and impulse-response methods allow, respectively, more general model forms and have more bias error. The three identification methods are shown to estimate pilot describing functions adequately from representative tracking task data from both single-input and two-input control tasks with various levels of external disturbances. The results appear satisfactory even when the primary excitation comes from the pilot's own output noise. Author

N71-18722* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ARRAY PHASING DEVICE Patent
Robert J. Mailloux, Paul R. Carson, and Francis J. La Russa, inventors (to NASA) Issued 17 Mar. 1970 (Filed 24 Jan. 1969) 9 p Cl. 343-100; Int. Cl. H04b7/00
(NASA-Case-ERC-10046; US-Patent-3,501,764; US-Patent-Appl-SN-793772) Avail: US Patent Office CSCL 09E

An apparatus for generating a series of microwave signals at positive and negative progressively phased angles is described. The device employs intermediate frequency multiplication and heterodyning to produce desired signals through use of only one precision phase shifter for each series of signals. A phase interpolation technique which permits doubling the number of phased output signals is also illustrated. Official Gazette of the U.S. Patent Office

N71-18723* Hughes Aircraft Co., Los Angeles, Calif.
A dc-COUPLED NONINVERTING ONE-SHOT Patent
Francis M. Pan, inventor (to NASA) Issued 17 Mar. 1970 (Filed 17 May 1967) 4 p Cl. 307-273; Int. Cl. H03k3/26 Sponsored by NASA Prepared for JPL

(NASA-Case-XNP-09450; US-Patent-3,501,649; US-Patent-Appl-SN-640459) Avail: US Patent Office CSCL 09E

A one-shot providing an output at the collector of a transistor which is of the same polarity as the controlling input level is reported. The duration of the outpulse is a function of the time required for a capcitor to charge up to a level at which the transistor is driven to conduction. The capacitor is not connected between the transistor and the input source, so that the one-shot may be thought of as dc-coupled. Official Gazette of U.S. Patent Office

N71-18724* General Precision, Inc., Little Falls, N.J.

REVERSIBLE CURRENT CONTROL APPARATUS Patent

Nathan Stern and Edward J. Rapoza, inventors (to NASA) Issued 31 Mar. 1970 (Filed 27 Jul. 1966) 6 p Cl. 318-257; Int. Cl. H02p1/18 Sponsored by NASA

(NASA-Case-XLA-09371; US-Patent-3,504,258; US-Patent-Appl-SN-568160) Avail: US Patent Office CSCL 09E

High efficiency reversible-current directing circuitry for controlling reversible motors is described. A control circuit that is responsive to an input signal directs current through a two-terminal control element in one direction while the input signal is positive and in the other direction while the input signal is negative. Official Gazette of the U.S. Patent Office

N71-18755# Naval Postgraduate School, Monterey, Calif.

RELATIONSHIPS BETWEEN THE SENSITIVITY MODEL AND THE MUTUALLY RECIPROCAL ADJOINT NETWORK

Bernd Guenter Sanne (M.S. Thesis) Sep. 1970 55 p refs

(AD-715564) Avail: NTIS CSCL 9/5

There are two methods which have been developed independently for computing network sensitivities. Both computations may be carried out in the frequency or in the time domains. One method involves the analyses of two networks - the original and its mutually reciprocal adjoint. The second method uses a sensitivity model for the circuit. It is shown that the sensitivity model and the mutually reciprocal adjoint circuit are essentially the same; the sensitivity model being useful for calculating single parameter sensitivity in the time domain, the adjoint circuit being useful for calculating sensitivity for several parameters in the frequency domain. Author (GRA)

N71-18772* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STEPPING MOTOR CONTROL CIRCUIT Patent

Joseph C. Thornwall, inventor (to NASA) Issued 6 Oct. 1970 (Filed 29 Oct. 1968) 10 p Cl. 318-138; Int. Cl. H02p7/28

(NASA-Case-GSC-10366-1; US-Patent-3,532,948; US-Patent-Appl-SN-771523) Avail: US Patent Office CSCL 09C

An apparatus is described for simultaneously exciting the windings of a stepping motor in the proper time sequence to cause the motor to rotate in either direction. A core array module remembers the prior direction of rotation of the motor. A plurality of flip-flops in combination with a blocking oscillator, a differential amplifier, and a number of gates control the application of power to the motor windings. By applying step pulses to the blocking oscillator and directional pulses to one of the flip-flops, the motor is made to move in one direction or the other. This involves converting a dc voltage into a bipolar voltage. E.M.C.

N71-18799# Stanford Univ., Calif. Stanford Electronics Labs.

THE SPOOF: A NEW TECHNIQUE FOR ANALYZING THE EFFECTS OF FAULTS ON LOGIC NETWORKS

Frederick W. Clegg Aug. 1970 47 p refs

(Contract N00014-67-A-0112-0044; Grant NSF GJ-165)

(AD-715627; SU-SEL-70-073; TR-11) Avail: NTIS CSCL 9/1

In general, one cannot predict the effects of possible failures on the functional characteristics of a logic network without knowledge of the structure of that network. The SPOOF or structure-and-parity-observing output function described in this report provides a new and convenient means of characterizing both network structure and output function in a single algebraic expression. A straightforward method for the determination of a SPOOF for any logic network is demonstrated. Similarities between SPOOFs and other means of characterizing network structure are discussed. Examples are presented which illustrate the ease with which the effects of any stuck-at fault--single or multiple-- on the functional characteristics of a logic network are determined using SPOOFs. It is also demonstrated how the SPOOF and other enumeration techniques which are developed may be used to establish upper bounds on, and in some cases exact counts of, the number of classes into which the faults which can occur in a network are partitioned by equivalence relations between these faults. Author (GRA)

N71-18800# Naval Postgraduate School, Monterey, Calif.

APPRAISING FEASIBILITY AND MAXIMAL FLOW CAPACITY OF A NETWORK

Alan W. McMasters 23 Oct. 1970 19 p refs

(AD-715546; NPS-55MG70101A) Avail: NTIS CSCL 12/2

The use of the dual graph in determining the value of the maximal flow capacity of an undirected network has been extended to directed networks. A directed dual graph is defined such that the length of the shortest route through this dual is equal to the maximal flow capacity of its directed primal. Feasibility of a specified exogenous flow for networks having positive lower bounds on arc flows can also be appraised. Infeasibility is indicated by a dual cycle of negative length. Author (GRA)

N71-18836*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A QUADRATIC PERFORMANCE INDEX FOR A VTOL AIRCRAFT PREFILTER MODEL REFERENCE ATTITUDE CONTROL SYSTEM

Terrence D. Gossett and Lloyd D. Corliss (Army Mobility R and D Lab.) Washington Mar. 1971 46 p refs

(NASA-TN-D-6231; A-2897) Avail: NTIS CSCL 01C

Several performance criteria methods for optimizing a prefilter model reference control system are reviewed, and the quadratic performance index is studied in detail. The prefilter model reference system consisted of a second-order model and a fourth-order follower. The form of this follower system was typical of that required for a VTOL aircraft in hover. For the VTOL problem, the quadratic performance index was found to be the most versatile and comprehensive criterion. Weighting matrices for various sytem states can be iterated until the desired system response is obtained; that is, if the response is too oscillatory, the elements of the weighting matrices can be changed to produce a less oscillatory response. A major advantage of the quadratic performance index is that it can be minimized through the use of readily available digital computer programs. The solution of these programs provides a set of optimal gains for a given system configuration and the chosen configuration. Constraints on the use of the quadratic performance index are that the index must be expressed in terms of states and the control vector, all states must be observable, and only linear system formulations are acceptable. Author

N71-18870 Rensselaer Polytechnic Inst., Troy, N.Y.

REDUCED SCATTERING IN MULTIMODE CIRCULAR WAVEGUIDES

John Philip Riganati (Ph.D. Thesis) 1969 210 p

Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 70-2641

The circularly symmetric transverse electric modes in round waveguide constitute one of the few energy forms which may, in theory, approach lossless transmission. The unique attenuation

characteristic of these electric modes may be traced to the fact that they and they alone have no longitudinal component of wall current. The naturally segmented structure of any guide of significant length may be viewed as a series of periodically spaced circumferential gaps each coupled to a coaxial cavity formed by the joining flange. A numerical solution for the field in the gap, the scattering matrix and the resultant propagation constants is given. The precise effect of the altered distribution of differential propagation constants depends on the nature of the mechanical deviations, but a reduction in scattered energy of 20% or more is not unreasonable. Dissert. Abstr.

N71-18976# Joint Publications Research Service, Washington, D.C.

PRINCIPLES OF INVESTIGATION AND IDENTIFICATION OF COMPLEX SYSTEMS IN CYBERNETICS

V. M. Svintsytskyy 1 Mar. 1971 17 p refs Transl. into ENGLISH from Filosofska Dumka (Kiev), no. 6, Nov.–Dec. 1970 p 79–89

(JPRS-52496) Avail: NTIS

The principles of structural systems analysis in cybernetics are examined. The main principle of theoretical construction of the world is given as the distinction of functional informational structures from the entire set of connections and relations of the investigated object. It permits finding a definite isomorphism of control processes in engineering, living nature, and society. The informational criterion of complexity of the system, based on the algorithmic method of determining the quantity of information, is cited as the sole objectively substantiated criterion. The Ashby concept of variety and the law of necessary variety are examined as ontological assumptions of the functional informational approach. The basic concept of structural systems analysis is a theoretical construct, undefined in terms of observations or intuitive feeling. The task of a complex dybamic system is correlated to the selection of a method of description. The characteristic conceptual procedure of structural identification of complex systems is examined on the basis of the given positions. Author

N71-19047# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.

ON A TWO-UNIT STANDBY REDUNDANT SYSTEM WITH IMPERFECT SWITCHOVER

Shunji Osaki (Hiroshima Univ.) Nov. 1970 20 p refs

(Contract NIH GM-16197-03)

(TR-70-46) Avail: Issuing Activity

Considering the failure of the switch-over device for a two-unit standby redundant system, the Laplace-Stieltjes transform and the mean time of the time distribution to the first system down are derived by using Markov renewal processes. Numerical comparison of the mean times with perfect switch-over and imperfect switch-over is presented. Author

N71-19048*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

A THREE-LAYER DISTRIBUTED RC NETWORK WITH TWO TRANSMISSION ZEROS

L. P. Huelsman Oct. 1970 20 p refs

(Grant NGL-03-002-136)

(NASA-CR-116860) Avail: NTIS CSCL 09C

The properties of a three-layer distributed RC network are described consisting of two resistive layers separated by a dielectric which may be used to realize two zeros of transmission on the j omega axis of the complex frequency plane. The relative location of the two zeros is controlled by the location of a contact placed on one of the resistive layers. Author

N71-19121*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

ON THE DESIGN OF OPTIMAL AND SUBOPTIMAL FEEDBACK SYSTEMS

Keith Millican Joseph (Ph.D. Thesis) Mar. 1970 144 p refs

(Grants NGL-22-009-124; NSF GK-2645, NSF GK-14125; MIT DSR Proj. 76285)

(NASA-CR-116895; ESL-R-421) Avail: NTIS CSCL 09C

A structural engineering constraint is considered which guarantees that any solution obtained subject to this constraint will be in a form for which there is a simple, direct, and easy means of implementation. A sequence of structural forms (interconnections of single-input-single-output function generators and ideal summers) from which the feedback control law will be constructed is specified while leaving the various synthesis functions free to be determined optimally. In this manner a structurally constrained optimal control problem (SCOCP) is formulated; it is established that such problems can be solved and that their solution is computationally feasible. A variety of optimal and suboptimal design procedures with explicit computational algorithms are developed for solving the SCOCP and examples illustrating their application are presented. Author

N71-19153# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON CONNECTION OF A PHOTO RECEIVER AND ELECTRONIC LOOP IN OPTICAL COMMUNICATIONS SYSTEMS

G. V. Voishvillo et al 1970 6 p refs Transl. into ENGLISH from Radiotekhnika (USSR), v. 125, no. 10, 1970 p 13–18

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The logical selection of the circuit parameters connecting a receiver into the electronic channel is discussed. The construction of various optical instruments included in communications systems and intended to record radiation by using a photo receiver and subsequent processing of the electrical signal is described. This problem is part of the more general matching problem, the problem of seeing a method of constructing the electronic loop for which the intrinsic noise level will be least. Author

N71-19164 Missouri Univ., Columbia.

SYNTHESIS OF SUBOPTIMAL FEEDBACK CONTROL LAWS FOR SECOND ORDER NONLINEAR SYSTEMS

Roland Paul Meyer (Ph.D. Thesis) 1969 106 p

Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-3005

The system is assumed to be second order, continuous and contains one or more odd functional nonlinearities. The performance index is taken as the integral quadratic type. To obtain the optimal control laws, the Minimum Principle of Pontryagin is used. These control laws are explicit functions of the initial conditions and time, and are thus considered to be open loop. It is assumed that feedback control laws are desired, which means the control law is an explicit function of the state variables, that suboptimal linear feedback control laws result in unacceptable increases in the performance index values, and that the region of expected initial conditions can not be adequately represented by one initial condition or one optimal state trajectory. Two graphical methods are developed and a digital computer procedure is discussed for approximating the optimal open loop control laws in a feedback manner. The form of the suboptimal feedback control laws is assumed as combinations of linear and PWL (piecewise linear) functions. The goodness of the approximation is given numerically by the per cent increase in the performance index values. Dissert. Abstr.

N71-19165# Pennsylvania Univ., Philadelphia. Towne School of Civil and Mechanical Engineering.

CONTINUUM THEORY OF SLENDER ELECTROSTATIC PROBES

Alan M. Whitman and Chung-Jen Chien Sep. 1970 19 p refs Submitted for publication
(Grant NSF GK-2281)
(Rept-2281/3) Avail: Issuing Activity

The continuum theory of electrostatic probes is developed for axisymmetric probes of arbitrary shape under the restriction that their maximum diameter is much smaller than their legnth. The current-voltage characteristic is not computed explicitly but it is shown that the saturation currents drawn by this class of probes as well as the current drawn by them at the plasma potential are all proportional to each other. This proportionality constant, a function of the probe shape, is calculated for a cylindrical probe which has spheroidal ends. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-18168# Centro Informazioni Studi Esperienze, Milan (Italy).
PROJECT OF AN 8 MeV TANDEM VAN de GRAAFF. PART 3: THE INJECTOR AND THE BEAM OPTICS
A. Cesati, F. Cristofori, and P. G. Sona Jun. 1970 42 p refs
(CISE-N-139) Avail: AEC Depository Libraries

The injector, negative ion source, injection focusing system, optics of the second acceleration tube, and the focusing system after acceleration, including electrostatic and magnetic elements, are described. NSA

N71-18218# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
IMPROVEMENT OF THE EXTENSION SYSTEM OF THE JINR SYNCHROCYCLOTRON BEAM
V. I. Danilov, I. B. Enchevich, E. I. Rozanov, V. I. Smirnov, and A. V. Shestov 1970 14 p refs In RUSSIAN
(JINR-P9-5208) Avail: AEC Depository Libraries

A thyristor trigger is described exciting in the coils of magnetic extension of a synchrocyclotron beam, a sawtooth pulse having rise time 6.5 ms, amplitude 130 A and frequency 110-115 Hz. Duration of the extracted extended beam of mesons is 70% of the acceleration cycle, while intensity equals 55% of the usual extraction without extension. Author (NSA)

N71-18230# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Theoreticheskoi i Ekseperimentalnoi Fiziki.
SYSTEM OF HEAT EXCHANGE AND THERMOSTABILIZATION FOR THE 2-METER LIQUID HYDROGEN BUBBLE CHAMBER OF THE ITEF [SISTEMA TEPLOOBMENA I TERMOREGULIEOVANIYA 2-METROVOI ZHIDKOVODORODNOI PUZYRKOVOI KAMERY ITEF]
I. L. Kiselevich, V. I. Moskalev, A. A. Platnikov, M. N. Ruzin, B. F. Schwarzman et al 1969 12 p refs In RUSSIAN; ENGLISH summary
(ITEF-734) Avail: AEC Depository Libraries

The heat-exchange and thermostabilization system of ITEP 2-metre liquid-hydrogen bubble chamber is described. The system provides a uniform temperature distribution and keeps the temperature constant within the chamber volume up to 0.1 deg. Author (NSA)

N71-18275# Kernforschungszentrum, Karlsruhe (West Germany). Inst. Fuer Reactorentwicklung.
KARLSRUHE SODIUM TANK TEST FACILITY
F. Huber and R. A. Mueller Jul. 1970 13 p Sponsored by US/Euratom
(EURFNR-819; KFK-1203) Avail: AEC Depository Libraries

The facility offers universal application allowing full scale and semi-technical scale studies of the many questions in the field of sodium technology. It consists of two vertical installed experimental tanks of 1 and 2 m diameter, respectively, the associated supply systems for sodium and cover gas, and a cover gas circulating system. The two experimental tanks are licensed for operating temperatures of 700 and 600 C, respectively. For experiments conducted at higher temperature, insert tanks, which can be heated separately, are installed into the experimental tanks; in this case, the experimental tanks serve as protective vessels only. The cover gas circulating system is designed to study the behavior of sodium aerosols in the cover gas and, if necessary, to provide purified and cooled cover gas for flushing and cooling. Author (NSA)

N71-18278# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton.
ELECTRONICALLY CONTROLLED HYDRAULIC SYSTEMS FOR EXTRACTOR MAGNETS
V. C. Cloke 1970 14 p refs Presented at 2d Natl. Conf. on Particle Accelerators, Moscow, 16–23 Sep. 1970
(RPP/N-21) Avail: AEC Depository Libraries

The mechanisms used for the extraction systems in general use on Nimrod are described. The large aperture of this accelerator dictates the use of large extraction systems using magnets of around 1000 kg in weight. These magnets are required to be plunged through 50 cm in approximately 0.5 S at a repetition rate of 22/min. The time between injection platform and fast spill is about 800 ms for normal 7 GeV running, however, a required dwell time of 200 ms after injection and 50 ms before spill effectively reduces the extractor magnet stroke time to 550 ms. At energies below 7 GeV, this time could be reduced to 400 ms. Speeds of this order require a peak power of some 150 hp (114 KW), which is transmitted through a hydraulic actuating mechanism. NSA

N71-18280# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
EXTRACTION TECHNIQUES AT NIMROD
D. A. Gray, M. R. Harold, R. H. C. Morgan, N. M. King, and M. J. O'Connell 13 Aug. 1970 14 p refs Presented at the 2d USSR Natl. Accelerator Conf., Moscow, 16–23 Sept. 1970
(RPP/N-22; CONF-700808-3) Avail: AEC Depository Libraries

The 7 GeV proton synchrotron Nimrod has three extracted beamlines. Two of these (X1 and X2) derive from a single extractor magnet, whose current is switched during flat-top to provide a fast spill for X1 and slow spill for X2. The third line (X3) serves the new experimental hall and is fed from a magnet which is situated 90 deg round the ring from X1. Until June 1970 the achromatic energy-loss extraction method was used for both channels, the extraction efficiency being typically around 30%. Since over 80% of the circulating beam is used for extraction purposes, plans were made to test two further methods of extraction with the aim of increasing this efficiency. Author (NSA)

N71-18281# Lyon Univ. (France). Inst. de Physique Nucleaire.
DESIGN AND DEVELOPMENT OF ACHROMATIC OPTICS FOR THE LYON SYNCHROCYCLOTRON [INSTALLATION ET MISE AU POINT D'UNE OPTIQUE ACHROMATIQUE SUR LES SYNCHROCYCLOTRON DE LYON]
Gerard Reboulet (Ph.D. Thesis) 27 Feb. 1970 51 p refs In FRENCH
(LYCEN-7004) Avail: AEC Depository Libraries

A high resoltuion analysis system for accelerator beams was develooped. A sensible improvement in the intensity of the beam at the target was obtained by using two conveniently placed magnetic analyzers. Thus the resoltuion was increased and effects arising from the target thickness were compensated by appropriately orientating the target with respect to the incident beam. The analysis systems adapted to the synchrocyclotron are studied. Their development and the tests used are explained. NSA

N71-18365# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

VACUUM-TUBE LAUNCHERS AND BOOSTERS

Louis D. Duncan and William J. Vechione Sep. 1970 34 p refs

(AD-715350; ECOM-5331) Avail: NTIS CSCL 19/7

Systems are being developed to investigate the feasibility of using an evacuated (vacuum) tube as either a launcher or booster for small to medium size projectiles. Two eight-inch diameter tubes are being fabricated to propel a one-to three-pound meteorological probe into the lower atmosphere. A 70-foot long tube can propel this projectile to approximately 7000 feet above ground level, while a 20-foot tube will send the same projectile to an altitude of approximately 3500 feet. A vacuum tube may be used to impart initial velocities in the range of 300 to 500 ft/sec to the ARCAS. This increased launch velocity will result in a 10 to 20 percent increase in peak altitude, with a simultaneous reduction in wind effect of 30 to 60 percent. Author (GRA)

N71-18452# Royal Aircraft Establishment, Famborough (England).

A SURVEY OF SOME EUROPEAN HYPERSONIC RESEARCH

D. Kuechemann 1970 13 p refs Presented at the 4th EUROSPACE US-European Conf., Venice, 22 – 25 Sep. 1970 Avail: NTIS

The aim of the Eurohyp program relating to hypersonic boundary layer and flow fields is reviewed. The experimental facilities available in Europe for investigating compressible boundary layers, lifting bodies, propulsion aerodynamics, and fluid dynamics of real gases are listed and discussed. It is concluded that the Eurohyp activities may well provide the basis for a future official European research program, including the aerodynamic design of hypersonic transport aircraft, a space shuttle, and its launcher. ESRO

N71-18466# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A TELEMETRY GROUND STATION FOR RESEARCH PURPOSES [EINE TELEMETRIEBODENSTATION FUER FORSCHUNGSAUFGABEN]

Peter Schulz May 1970 48 p refs In GERMAN; ENGLISH summary

(DLR-Mitt-70-17) Avail: NTIS; ZLDI Munich: 12 DM

A ground station for telemetry research purposes in the field of aeronautics and astronautics is described and its different tasks outlined. The theory of operation and equipment specifications are discussed in detail. Author (ESRO)

N71-18467# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).

ENVIRONMENTAL TEST FACILITIES [MOYENS D'ESSAIS D'AMBIANCE]

A. Coty 2 Nov. 1970 38 p In FRENCH

(LRBA-NT-15/70/DAF) Avail: NTIS

Test and measuring procedures available at the environmental laboratory of the Laboratoire de Recherches Balistiques et Aerodynamiques (LRBA) are described. The possibilities and limitations of test procedures such as vibration testing are particularly examined. ESRO

N71-18578* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HYPERVELOCITY GUN Patent

Thomas N. Ganning, inventor (to NASA) Issued 9 Sep. 1969 (Filed 23 Aug. 1967) 5 p Cl. 89-8; Int. Cl. F41f1/00, 17/00 (NASA-Case-XAC-05902; US-Patent-3,465,638; US-Patent-Appl-SN-662828) Avail: US Patent Office CSCL 14B

The projectile gun is an implosion drive, light-gas gun, having a launching tube made of ductile or yieldable material. A light propellant gas is between the closed end of the launching tube and the projectile. A high explosive charge surrounds the tube from the closed end half way to the projectile. An initiator at the closed end is fired to cause the high explosive charge to explode progressively along the tube's exterior, producing a continuously advancing detonation front. This action results in the radial implosion of the tube, compressing the propellant gas at a constant rate. As a consequence, a single strong hydrodynamic shock wave advances continuously, impinging on the projectile and propelling it along the tube. N.E.N.

N71-18593# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

HYPERSONIC LOW DENSITY WIND TUNNEL PLANT [EINE HYPERSONISCHE WINDKANALANLAGE FUER KLEINE GASDICHTEN]

G. Hefer, G. Koppenwallner, H. Legge, and W. Wuest Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss Sep. 1970 93 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.

(BMBW-FB-W-70-51) Avail: NTIS; ZLDI Munich: 19,10 DM

A new plant consisting of a vacuum tunnel with two test sections of different sizes and Mach number ranges and a high vacuum tunnel with two separate pumping systems is described. The auxiliary equipment, serving mainly the electroforming and electroplating of the wind tunnel models and the cooling of models and nozzles by liquid nitrogen, is also described. A short survey on research work carried out in the hypersonic tunnel is given. Author (ESRO)

N71-18651# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.

DEVELOPMENT AND CALIBRATION OF A MACH 1.2 RAIN EROSION TEST APPARATUS Technical Report, Mar. 1966 – Aug. 1969

Charles J. Hurley and George F. Schmitt, Jr. Oct. 1970 79 p refs

(AD-715909; AFML-TR-70-240) Avail: NTIS CSCL 14/2

Development of a Mach 1.2 rain erosion test apparatus is described. This rotating arm apparatus is capable of evaluating the relative rain erosion resistance of materials and can be operated at speeds of 450 to 900 mph in a 1 or 2 inch/hour simulated rainfall. The report describes the design and development of the apparatus including the rotating arm, power train, test enclosure, rain simulation and control systems. Calibration and correlation experiments are also described. Author (GRA)

N71-18717# Air Force Systems Command,Wright-Patterson AFB, Ohio. Aero Propulsion Lab.

OPERATING CHARACTERISTICS OF THE AFAPL HYPERSONIC SHOCK TUNNEL Technical Report, Jun. 1966 – Feb. 1969

R. R. Craig Aug. 1970 41 p refs

(AD-715907; AFAPL-TR-70-2) Avail: NTIS CSCL 14/2

A description is presented of the development efforts accomplished to make the AFAPL Hypersonic Shock Tunnel an operational aerodynamic facility. A semiconductor strain gage pressure transducer was developed to overcome calibration problems with the original pressure transducer design. Heat transfer

measurements were initially made using standard shock tunnel thin film gage technology. Gage erosion problems were solved through use of a surface thermocouple which uses n-p germanium crystal elements. Improved data recording capability was achieved with the installation of a 64 channel digital data system. A contoured nozzle with interchangeable throats to provide parallel uniform flows at Mach 8, 9, 10, and 11 was installed and calibrated. The nozzle produced good flow profiles up to six feet from the nozzle exit. Author (GRA)

N71-18773* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE ENVIRONMENTAL WORK SIMULATOR Patent

William G. Simpson and Hill M. Walker, inventor (to NASA) Issued 20 Oct. 1970 (Filed 23 Feb. 1968) 4 p Cl. 35-12; Int. Cl. B64g7/00

(NASA-Case-XMF-07488; US-Patent-3,534,485; US-Patent-Appl-SN-707495) Avail: US Patent Office CSCL 14B

An easy access vacuum chamber is described which makes it possible to simulate the carrying out of various physical operations in a vacuum environment similar to that encountered in outer space. This is made possible by mounting portions of a space suit to the wall of a vacuum chamber in such manner than an operator standing outside the chamber can get into the space suit and perform experiments with materials that have been placed in the chamber. The operator can view his manipulations through the transparent head enclosure. E.M.C.

N71-18814# National Aviation Facilities Experimental Center, Atlantic City, N.J.

INVESTIGATION AND TEST FOR A FUTURE SOLID STATE TERMINAL VOR FACILITY Final Report, Jan. 1969–Jan. 1971

Wesley O. Mickey Feb. 1971 62 p

(FAA-RD-70-54; FAA-NA-70-32) Avail: NTIS

Technical information from the test of an available commercial 10-watt solid state VOR to assist in preparing specifications for a future type terminal VOR facility is reported. The investigation included low altitude flight tests by project aircraft, ground checks, remote receiver monitoring, and the standard flight inspection at high altitude. A conclusion was that solid state is practical and provides stability and reliability with less requirement for maintenance only if special care is given to the design of circuits. Author

N71-18841# National Research Council of Canada, Ottawa (Ontario).

BLACK BODY FURNACES OF THE ITALIAN INSTITUTE OF THERMOMETRY FOR THE CALIBRATION OF OPTICAL PYROMETERS [FORNI PER CORPI NERI DELL-ISTITUTO TERMOMETRICO ITALIANO PER TERATURE DI PIROMETRI OTTICI]

T. Ricolfi et al 1970 8 p refs Transl. into ENGLISH from Termotecnica (Milan), v. 21, no. 11, 1967 p 48–50

(NRC-TT-1432) Avail: NTIS

The construction of two black body furnaces is described. One of them can be operated up to 1100 C, and its main feature is low thermal inertia affording good temperature control. The temperature over the length of the enclosure is uniform within + or − 0.1 C and temperature drifts are normally less than 0.1 C per hour, the load current being automatically controlled. The other one has five independent heaters insuring a uniform temperature zone in the middle up to 1500 C. Author

N71-18914*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.

LARGE AREA PULSE IONIZATION CHAMBER FOR MEASUREMENT OF EXTREMELY HEAVY COSMIC RAYS

J. W. Epstein, J. I. Fernandez, M. H. Israel, J. Klarmann, R. A. Melwaldt et al [1970] 29 p refs Sponsored in part by McDonnell-Douglas Co.

(Grant NGR-26-008-001)

NASA-CR-116874) Avail: NTIS CSCL 14B

Parallel-plate ionization chambers with nearly one sq m active area were constructed and operated in a series of high-altitude balloon flights. The chambers are used for identification of relativistic cosmic-ray nuclei with charge greater than or equal to 20. For relativistic iron nuclei the charge resolution achieved is 5.5 percent. Author

N71-19149# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.

INTEGRATED SAFEGUARDS EXPERIMENT Quarterly Report, May–Aug. 1970

D. C. Wadekamper and L. T. Hagie, comps. Aug. 1970 7 p ref

(Contract AT(30-1)-68)

(GEAP-12114-2; BHO-68-2; QR-1) Avail: NTIS

The program is directed toward evaluating the usefulness to safeguards of material balance techniques which employ only measured data. The available historical data are summarized, and accomplished experimental planning is defined. The first experiment was started. Author (NSA)

N71-19170# Weapons Research Establishment, Salisbury (Australia).

FURTHER FLOW CALIBRATION IN THE BLOWDOWN WIND TUNNEL S3

M. L. Robinson Jun. 1970 29 p refs Supersedes WRE-TN-HSA-115

(WRE-TN-HSA-171) Avail: NTIS

The distribution of Mach number in the 7 in by 6 in working section of wind tunnel S3 was measured at Mach numbers 2.8, 3.5, 4.0 and 5.0. The results given supersede those of the previous calibration tests carried out in 1965 at which time no Mach number 3·5 nozzle was available. The present calibration results differ by about 0·02 in Mach number from the previous test results for the unmodified Mach number 2·8 and 4·0 nozzles. Remachining of the Mach number 5.0 nozzle blocks has not improved the uniformity of flow produced by the nozzle. The standard deviation of Mach number in the working section is 0·3% for the Mach number 2·8 and 3·5 nozzles, 0·4% for the Mach number 4·0 nozzle and 0·6% for the Mach number 5·0 nozzle. Design ordinates for the Mach number 3·5 nozzle are given, and Mach number distributions for all nozzles are presented in tabular and graphical form. Author

N71-19328# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

NEUTRON SENSITIVE CRITICALITY DETECTION SYSTEM

P. C. Friend and C. A. Ratcliffe [1970] 8 p refs Presented at IEEE Nucl. Sci. Symp., New York

(Contract AT(45-1)-1830)

(BNWL-SA-3365; CONF-701109-2) Avail: NTIS

An alarm system to detect and warn against uncontrolled nuclear criticality events has been developed for the Hanford site. The system is neutron sensitive with an alarm threshold of 8 millirad/hour of steady neutron irradiation or 4 microrad of pulsed radiation. Redundancy techniques and self-check features have been incorporated whenever possible to enhance operational reliability. Author (NSA)

N71-19342# Oak Ridge National Lab., Tenn. Isotopes Development Center.

MULTIPURPOSE BUILDING FOR PROCESSING ALPHA, BETA, GAMMA, AND NEUTRON EMITTERS

R. W. Schaich Dec. 1970 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3225) Avail: NTIS

The physical facilities, operations, and operating procedures for a multipurpose radioisotope processing building are described. Author (NSA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-18161# Atomic Energy of Canada Ltd., Chalk River (Ontario).
RESULTS OF TWO-PHASE BLOW-DOWN EXPERIMENTS. PART 1: STRAIGHT TUBE TEST SECTION
R. F. White Aug. 1970 73 p refs
(AECL-3664) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $2.00

Experiments on the blowdown rig have yielded detailed information of the behavior of flowing two-phase steam-water mixtures during the first 100 ms after rupture of a diaphragm at the end of a pipe 15 feet long and 0.621 in. ID. Blowdown tests were made from initial pressures of 485 psia and 1002 psia and steam qualities from 8% to 31%. Pressure transients measured at three positions about 7 feet apart in the test section showed that the transition from the pre-blowdown pressure gradient to that corresponding to critical discharge occurred in about 100 ms after rupture. Measured rarefaction wave velocities were in the range 1520 to 1570 ft/sec and all were within 6% of corresponding theoretical values. Measured masses of water discharged during the first 100 ms after diaphragm rupture agreed with values predicted by the homogeneous model for steady state two-phase critical flow, contrary to critical discharge rates measured under steady state conditions which agree with an annular two-phase critical flow model. Author (NSA)

N71-18261# Cooper Union, New York.
MASS TRANSFER OF AEROSOLS WITH AXIAL DIFFUSION IN CIRCULAR TUBES
C. W. Tan AEC Oct. 1970 57 p refs Sponsored by AEC, New York
(HASL-238) Avail: NTIS

A mathematical analysis of the diffusion of particles flowing in a circular tube has been done taking into account axial as well as radial diffusion. Both the case of particles entering the inlet, without formation in the channel, and the case of particles forming uniformly within the tube were considered for the two conditions of slug flow and Poiseuille flow. For slug flow, closed analytical solutions of the basic differential equations are presented. For Poiseuille flow, solutions were obtained with the aid of a high speed digital computer. Two detailed tables are given which permit calculation of aerosol diffusion constants from experimental parameters, with or without formation of aerosols within the diffusion tube. Author (NSA)

N71-18316# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
ASYMMETRIC CAVITATION BUBBLE COLLAPSE NEAR SOLID OBJECTS
Frederick G. Hammitt, Charles L. Kling, Terry M. Mitchell, and Edward E. Timm Nov. 1970 6 p refs
(Grant NSF GK-13081)
(PB-195427; UMICH-03371-61) Avail: NTIS CSCL 20D

A brief review is given of research and theories on cavitation bubble damage. GRA

N71-18366# Hydronautics, Inc., Laurel, Md.
THE MEASUREMENT OF BUBBLE SIZE DISTRIBUTION USING SCATTERED LIGHT
I. Ianda, E. S. Tabsy, V. Johnson, and J. Lawrence Jun. 1970 61 p refs
(Contract N00014-67-C-0162)
(AD-715347; TR-707-4) Avail: NTIS CSCL 20/4

The bubble size distribution in a flow is obtained by measuring light energy scattered from a bubble. A laser beam is passed through the test section at an angle of 60 deg to the flow direction. On the opposite side of the test section a receiver, composed of lenses and slits, discriminates a small volume of the laser beam. Bubbles flowing through this volume scatter light into the receiver. A photomultiplier tube converts the light into an electric pulse. The pulse height is proportional to bubble size. The pulse are shaped, counted, and grouped according to their height by a pulse height analyzer. After a predetermined time the number of bubbles versus size is displayed on an oscilloscope or x-y plotter. The system has measured bubbles in the range of 0.005 to 0.04 inches. Optimizing the operating angle and reducing noise should allow measurement in the range of 0.001 inch. Author (GRA)

N71-18400# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
FREE JETS IN RAREFIED ATMOSPHERE [JETS LIBRES EN ATMOSPHERE RAREFIEE]
Gerard Dupeyrat and Michel Giat Sep. 1970 45 p refs In FRENCH; ENGLISH summary
(Rept-70-10) Avail: NTIS

A systematic experimental study of free jets bursting out of the sonic nozzle in a caisson of great dimensions is made. The pressure ratios between the generating pressure p sub o and the caisson pressure p sub c are between 1000 and 60,000 (between 3 and 70 microns Hg). The photographs obtained by visualization with an electron beam verify the similarity between the central bodies of the jets and, in particular, the Sherman law giving the position of Mach shock disc. The structure of the jet, in density, has been obtained with the electron beam in the form of isochor nets showing clearly the jet boundary, the shock zones, and part of the flow behind the Mach shock disc. For caisson pressures decreasing down to 3 microns Hg, the evolution of shock zones, especially of the Mach shock disc has been shown till their disappearance. Author (ESRO)

N71-18401*# Scientific Translation Service, Santa Barbara, Calif.
CONTRIBUTION TO THE STUDY OF SONIC FLOWS PAST AN OBSTACLE
D. Euvrard Washington NASA Feb. 1971 17 p refs Transl. into ENGLISH from Proceedings of the 8th Symp. on Advanced Probl. and Methods in Fluid Dyn. (Tarda), 18–25 Sep. 1967 p 369–377
(Contract NASw-2035)
(NASA-TT-F-13472) Avail: NTIS CSCL 20D

The main findings of a series of investigators dealing with sonic flow past an obstacle of finite dimensions are summarized. A detailed study is made of the regions upstream and downstream from the shock waves in the case of an airfoil in a flow which is uniform and sonic at infinity. Cases of symmetrical and asymmetrical flow are also considered. A case involving a three-dimensional flow is also presented. F.S.

N71-18428*# Aeronautical Research Associates of Princeton, Inc., N.J.
A STUDY OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS USING THE METHOD OF INVARIANT MODELING
John E. Yates, Coleman duP. Donaldson, and Barry D. Gilligan Jan. 1971 16 p refs
(Contract NASw-1777)
(NASA-CR-116781; ARAP-71-4) Avail: NTIS CSCL 20D

Based on the compressible Navier-Stokes equations, the model equations were derived appropriate for studying compressible turbulent boundary layers. The model equations are written in finite difference form by an automatic differencing program, and an automatic grid spacing program is developed for the solution of the difference program. F.O.S.

N71-18427*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ACCURACY OF PITOT-PRESSURE RAKES FOR TURBULENT BOUNDARY-LAYER MEASUREMENTS IN SUPERSONIC FLOW

Earl R. Keener and Edward J. Hopkins Washington Mar. 1971 17 p refs

(NASA-TN-D-6229; A-3725) Avail: NTIS CSCL 20D

Boundary-layer profiles from three conventional pitot-pressure rakes and a new probeless rake are compared with those from a single traversing probe in a supersonic turbulent boundary layer on the wall of a wind tunnel. Measurements were made at Mach numbers from 2.4 to 3.4 and at momentum-thickness Reynolds numbers from 26,000 to 75,000. The boundary-layer thickness was approximately 6 inches and the rake heights were 5, 8, and 12 inches with different probe size and spacing. The pitot pressures from both the conventional rakes and the probeless rake agree with the single traversing-probe pressure within 2 percent of the edge pitot pressure. The resulting errors in Mach number and velocity ratios are less than 2 percent; momentum and displacement thickness errors are less than 4 percent. These errors are not excessive and indicate that multi-probe and probeless rakes can be used in measuring turbulent boundary layer. The low error of the probeless rake indicates that this type of configuration might have useful application at high temperatures where conventional rake probes might warp or fail. Author

N71-18440# Aviatest GmbH, Duesseldorf (West Germany).

THEORETICAL INVESTIGATIONS OF EXPANSION AND HYPERSONIC CHARACTERISTICS OF TWO PHASE WATER-AIR MIXTURES AND EXPERIMENTS ON SHOCK WAVE VISUALIZATION [THEORETISCHE UNTERSUCHUNGEN ZUM EXPANSIONS- UND UEBERSCHALLVERHALTEN SOWIE EXPERIMENTELLE UNTERSUCHUNGEN ZUR SICHTBARMACHUNG VON VERDICHTUNGSSTOESSEN AN ZWEIPHASEN-WASSER-LUFT-GEMISCHEN]

V. Denk, K. F. Leisinger, and H.-E. Grote Bonn Bundeswehramt 1970 68 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVtdg-FBWT-70-2) Avail: NTIS; Bundeswehramt, Bonn: 25 DM

The expansion characteristics of two phase flows at isothermal and adiabatic change of state in the gas phase are investigated and the values compared with the measurements. Subsequently the equations for shock waves in the two phase flow are deduced and analogies to gas dynamics are shown. Some optical methods are examined for shock visualization. In addition to the shadowgraph method some tests with light refraction and scattering are performed. Author (ESRO)

N71-18454# Ballistic Research Labs., Aberdeen Proving Ground, Md. Exterior Ballistics Lab.

GENERALIZATION OF THE SIMILARITY EQUATIONS FOR CONTINUOUS SURFACE BOUNDARY LAYERS

James E. Danberg Oct. 1970 47 p refs

(AD-715852; BRL-1504) Avail: NTIS CSCL 20/4

Through a generalization of the continuous surface problem (i.e., boundary layers on a moving belt or behind a shock wave), an equation is derived which encompasses many of the well known similarity solutions of boundary layer theory as well as some solutions not previously considered. Since these problems involve both free stream and wall velocities, similarity variables are introduced which depend on velocity differences. The parameter B = U sub infinity/(U sub W−U sub infinity) describes the relative importance of the boundary conditions along with the usual pressure gradient parameter, beta. This formulation of the problem includes the following special cases: flat plate (Blasius), accelerating or decelerating flow (Falkner-Skan), boundary layer behind a shock or expansion wave (Mirels), continuous surface (Sakiadis) and accelerating wall and free stream (Moore). Two new conditions not previously considered involve reverse flow and acceleration and deceleration of a continuous surface boundary layer. Preliminary numerical calculations have been made for these conditions. Author (GRA)

N71-18455# Michigan Univ., Ann Arbor.

TRANSONIC ROTATIONAL FLOW AROUND A CONVEX CORNER Final Report, 21 May 1969 – 30 Sep. 1970

Thomas C. Adamson, Jr. 30 Sep. 1970 3 p ref

(Contract DAHC04-69-C-0074)

(AD-715739; AROD-8097.2-E) Avail: NTIS CSCL 20/4

Results and conclusions are presented for the following problems. The development of a systematic method of solution for rotational inviscid transonic corner flows where the entropy gradient at the wall may have an arbitrary order of magnitude and the application of the method to the transonic part of a supersonic boundary layer turning a sharp corner, including both two dimensional and axially symmetric cases. Author (GRA)

N71-18471# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Abteilung Aeroakustik und Instabilitaet.

A NOTE ON THE SPATIAL JET-INSTABILITY OF THE COMPRESSIBLE CYLINDRICAL VORTEX SHEET

Alfons Michalke Oct. 1970 20 p refs

(DLR-FB-70-51) Avail: NTIS; ZLDI Munich: 6.20 DM

The linearized inviscid disturbance equations were derived for a compressible circular jet with variable temperature and density profile. The eigenvalue changes of the instability problem for the cyldindrical vortex sheet were computed and discussed for the variations with Strouhal and Mach numbers, and temperature ratios. It was found that contrary to temporal amplification the phase velocity of spatially growing disturbances can exceed the jet velocity. Furthermore, additional disturbance modes can exist in the spatial case. Author (ESRO)

N71-18480*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL WAKE SURVEY BEHIND A 120 DEG INCLUDED ANGLE CONE AT ANGLES OF ATTACK OF 0 DEG AND 5 DEG, MACH NUMBERS FROM 1.60 TO 3.95, AND LONGITUDINAL STATIONS VARYING FROM 1.0 TO 8.39 BODY DIAMETERS

Clarence A. Brown, Jr., James F. Campbell, and Dorothy H. Tudor Washington Jan. 1971 344 p refs

(NASA-TM-X-2139; L-7517) Avail: NTIS CSCL 20D

An investigation was conducted to obtain flow properties in the wake of a 120 deg-included-angle cone at Mach numbers from 1.60 to 3.95 and at angles of attack of 0 deg and 5 deg. The wake flow properties were calculated from total and static pressures measured with a pressure rate at longitudinal stations varying from −0.42 to 3.0 body diameters. These measurements showed a consistent trend throughout the range of Mach numbers and longitudinal distances and an increase in dynamic pressure with increasing downstream position. Author

N71-18487# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

THE STABILITY OF STEADY FINITE AMPLITUDE CONVECTION IN A ROTATING FLUID LAYER
Guenther Kueppers Apr. 1970 22 p refs
(IPP-6/86) Avail: AEC Depository Libraries

The stability of finite-amplitude convective flow in an infinite, horizontal fluid layer rotating rigidly about a normal axis is investigated for the case of rigid boundary conditions and finite Prandtl numbers. Solutions of the nonlinear steady-state equations are derived approximately by an amplitude expansion. It can be shown by a stability calculation that all three-dimensional solutions are unstable and, furthermore, for a given value of the Prandtl number there exists a critical value of the Taylor number above which the only stable two-dimensional rolls become unstable, too. This means there is a transition from pure heat conduction to time-dependent convective flow. Author (NSA)

N71-18520# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
TURBULENT BOUNDARY LAYER MEASUREMENTS AT HYPERSONIC MACH NUMBERS Final Report
Anthony W. Fiore Aug. 1970 89 p refs
(AD-715927; ARL-70-0166) Avail: NTIS CSCL 20/4

An experimental investigation was conducted to determine the structure and integrated properties of turbulent boundary layers at hypersonic speeds. These properties were deduced from pitot pressure and total temperature surveys made through the boundary layer at various locations on the wall of both a contoured and a conical nozzle. Tests were conducted at average Mach numbers of 11.89 and 10.83 respectively. The corresponding momentum Reynolds numbers ranged from 650 to approximately 1330. The data were obtained in the presence of both a favorable pressure gradient and heat transfer. The results indicate that the density distribution, the static temperature distribution, and the total enthalpy ratio versus the velocity ratio profiles through the boundary layer do not agree with the Crocco theory. The data also indicate that the sublayer is very thick and is approximately 25% as thick as the boundary layer itself. Depending upon the momentum Reynolds number, the sublayer can be either fully subsonic or partially subsonic and partially supersonic in nature. In addition, the transformed velocity profile data and the law of the wall in its incompressible form do not agree. Finally, the skin friction coefficient obtained from the Baronti-Libby transformation and Coles law of corresponding stations is about 15% to 35% greater than that calculated using the Spalding-Chi semi-empirical technique. Author (GRA)

N71-18542# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
THE BOUNDARY LAYER OF PARTICULATE FLOW IN CASCADE NOZZLES
A. Named and W. Tabakoff Nov. 1970 41 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-715721; THEMIS-AE-70-16; AROD-T-4-24-E) Avail: NTIS CSCL 20/4

The boundary layer of gas-particle flows in fields of changing pressures is analyzed. The analysis, which utilizes the momentum integral method, can be used to study the boundary layer of any particulate flow with incompressible gas-phase provided the flow properties outside the boundary layer are known. Numerical integration of the two momentum integral equations was carried out for the case of particulate flow in cascades. For this example, the results indicate that introduction of particles leads to an increase in the gas boundary layer thickness and that the gas boundary layer characteristics are usually more sensitive to particle concentration than any other particulate flow parameter. Author (GRA)

N71-18576*# Translations Consultants, Ltd., Arlington, Va.
EQUILIBRIUM SHAPES OF THE FREE SURFACE OF A FLUID IN GRAVITATIONAL AND MAGNETIC FIELDS WITH SURFACE TENSION FORCES TAKEN INTO CONSIDERATION [RAVNOVESNYYE FORMY SVOBODNOY POVERKHNOSTI ZHIDKOSTI V GRAVITATSIONNOM I MAGNITOM POLYAKH S UCHETOM SIL POVERKHNOSTNOGO NATYAZHENIYA]
V. M. Shashin et al. Washington NASA Feb. 1971 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), No. 3, May–Jun. 1970 p 113–116
(Contract NASw-2038)
(NASA-TT-F-13462) Avail: NTIS CSCL 20D

A surface equation is derived for a fluid experiencing the combined effect of a gravitational and a magnetic field, using the variational principle of minimum free energy. The equilibrium shape of the surface of a fluid in a vessel is calculated with allowance for the forces acting on a weakly magnetized fluid in a nonuniform magnetic field. It is shown that by using strong magnetic fields it is possible to solve such problems as controlling the behavior of fluids in tanks under conditions of weightlessness, and to simulate weightlessness over prolonged periods of time with some degree of accuracy. Author

N71-18598# Max-Planck-Institut fur Stromungsforschung, Gottingen (West Germany).
EXPERIMENTAL INVESTIGATIONS OF A TURBULENT CHANNEL FLOW WITH HIGHLY VISCOUS WALL LAYERS [EXPERIMENTELLE UNTERSUCHUNGEN IN EINER TURBULENTEN KANALSTROEMUNG MIT STARKEN VISKOSEN WANDSCHICHTEN]
H. Eckelmann 1970 76 p refs In GERMAN *Its* Mitt. aus dem Max-Planck-Inst. fuer Stroemungsforsch. und Aerodyn. Versuchsanstalt No. 48
Avail: NTIS

Hot-film velocity measurements were carried out in a flow channel for turbulent oil flow. The Reynolds numbers for the channel width and flow velocity in the channel center were 5600 and 3200. The strength of the mostly viscous wall layers were of the order of 1 cm. Frequency distributions of the instantaneous flow velocity were measured. ESRO

N71-18603* General Precision Systems, Inc., Little Falls, N.J. Aerospace Group.
FLUIDIC-THERMOCHROMIC DISPLAY DEVICE Patent
Edwin H. Hilborn and Daniel Grafstein, inventors (to NASA) Issued 23 Jun. 1970 (Filed 1 Jul. 1968) 8 p Cl. 40-28; Int. Cl. G09f11/00 Sponsored by NASA
(NASA-Case-ERC-10031; US-Patent-3,516,185; US-Patent-Appl-SN-741461) Avail: US Patent Office CSCL 20D

A display device is described in which a selectively controlled output of liquids or gases impinges upon a surface containing thermochromic materials to yield a readily observable and reversible color change. The color transition is sharp and is clearly visible under high ambient light conditions.
Official Gazette of the U.S. Patent Office

N71-18615* TRW Systems, Redondo Beach, Calif.
SEMITOROIDAL DIAPHRAGM CAVITATING VALVE Patent
Albert L. Young, inventor (to NASA) Issued 6 Oct. 1970 (Filed 21 May 1968) 7 p Cl. 137-594; Cl. 138-46; Cl. 251-61.1; Cl. 251-127; Cl. 251-333; Cl. 251-342; Int. Cl. F17d1/04; Int. Cl. F16k7/17 Sponsored by NASA
(NASA-Case-XNP-09704; US-Patent-3,532,118; US-Patent-Appl-SN-730701) Avail: US Patent Office CSCL 20D

The valve has throttling and cavitation controlled flow and a casing containing a fixed member which supports an annular protrusion. The protrusion is at least partially surrounded by a semitoroidal metal diaphragm to define an annular valve chamber. The gap between the apex of the protrusion and the diaphragm

functions as a throat and the downstream side of the chamber is shaped to cause cavitation of the fluid. The diaphragm is mounted on a set of cylinders at least one of which is flexurally supported for axial movement to vary the gap. Controlled throttling and cavitation is accomplished by selectively varying the gap. A compact biliquid configuration including actuating means is effected by mounting a set of the annular protrusions on opposite faces of the common fixed member. Official Gazette of the U.S. Patent Office

N71-18618# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
TEMPERATURE DISTRIBUTION IN THIN FLOWING FLUIDS HEATED BY A HOT GAS STREAM AND A HOT WALL PART 1: THEORETICAL TREATMENT [TEMPERATURVERTEILUNG IN DUENNEN FLUESSIGKEITSSCHICHTEN BEI AUFHEIZUNG DURCH EINEN HEISSEN GASSTROM UND EINE HEISSE WAND. TEIL 1: THEORETISCHE ERFASSUNG]
Klaus Piontka Dec. 1969 29 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-69-98-Pt-1) Avail: NTIS; ZLDI Munich: 8.50 DM

The fundamental equations describing the heat and mass transfer at the fluid surface are placed together and solved by an iteration procedure. This is a means of finding out the temperature distribution by solving the partial energy equation as a boundary value problem. The energy equation is then solved by a difference method in the second part of this calculation. For the exact computation of this problem, it is necessary to calculate the boundary layer equations both in the fluid and in the gas for the determination of velocity and concentration gradients. But it can be simplified if a separate flow net is assumed and the analogies following from the similarity principle between heat and mass transfer are taken as a basis. Author (ESRO)

N71-18622*# Scientific Translation Service, Santa Barbara, Calif.
APPLICATION OF A MIXING LENGTH SCHEME TO THE STUDY OF EQUILIBRIUM TURBULENT BOUNDARY LAYERS [APPLICATION D'UN SCHEMA DE LONGUEUR DE MELANGE A L'ETUDE DES COUCHES LIMITES TURBULENTES D'EQUILIBRE]
Roger Michel et al Washington NASA Feb. 1971 87 p Transl. into ENGLISH of ONERA, Paris, Tech. Note No. 154
(Contract NASw-2035)
(NASA-TT-F-13463) Avail: NTIS CSCL 20D

A turbulence scheme, based on an improved concept of mixing length, is applied to equilibrium turbulent boundary layers. Assuming an incompressible flow, the velocity profiles of a boundary layer subjected to both pressure gradient and fluid transfer at the wall are determined, as well as the influence of these two parameters on the wall friction. This treatment is extended to the compressible case. The laws are established for the velocity and enthalpy profiles. It is shown that pressure gradients have a considerable influence on the value of the Reynolds analogy factor. Author

N71-18632*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NON-STEADY FLOW DIRECTION GENERATION AND MEASUREMENT
Lloyd N. Krause and Robert L. Summers [1971] 10 p refs Proposed for presentation at 17th Natl. Aerospace Instrumentation Symp., Las Vegas, 10–12 May 1971; Sponsored by Instr. Soc. of Am.
(NASA-TM-X-52962) Avail: NTIS CSCL 20D

A generator of non-steady airflow direction has been developed to test the ability of a flow-direction probe to indicate the instantaneous direction of a fluctuating airflow. The probe is a 3-tube assembly using two beveled tubes to sense direction and a central square-ended total-pressure tube. Typical test data indicate that, within the dynamic pneumatic response capability of the probe, it measures transient flow direction to within + or − 0.5 degrees. An example is presented where flow turbulence measured by the 3-tube probe is compared with the measurement provided by a hot-wire anemometer. Author

N71-18633*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL GAS EFFECTS IN FLOW METERING
Robert C. Johnson [1971] 20 p refs Proposed for presentation at the Symp. on Flow: Its Meas. and Control in Sci. and Ind., Pittsburgh, 10–14 May 1971
(NASA-TM-X-52965) Avail: NTIS CSCL 20D

Methods of computing the mass flow rate of nonperfect gases are discussed. Data for computing mass flow rates through a sonic nozzle are given for air, nitrogen, oxygen, normal and para-hydrogen, argon, helium, steam, methane, and natural gas at pressure ranges to about 100 atm. For steam, the temperature ranges from 550 to 800 K are considered. For the other gases, the temperature range is from 250 to 400 K. Author

N71-18634*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF FLOW MAGNITUDE AND DIRECTION BY HOT WIRE ANEMOMETER
Gene L. Minner and Robert W. Fox (Purdue Univ.) [1971] 15 p refs Proposed for presentation at Symp. on Flow: Its Meas. and Control in Sci. and Ind., Pittsburgh, 9–14 May 1971
(NASA-TM-X-52967) Avail: NTIS CSCL 20D

A technique is developed for the measurement of mean velocity direction and magnitude and the turbulence quantities in incompressible fluid flow within a plane, when the flow direction is known only approximately within the plane. A low degree polynomial is fit to the calibration data by least squares, in the form: square root of velocity versus square of voltage. A normal component cooling model accounts for probe directional sensitivity. Calibration is performed at flow directions near those expected in the measurement situation, and the model is used to find a calibrated wire reference angle. Measurements of turbulent shear stress in fully developed pipe flow gave excellent agreement with a theoretical prediction of total shear distribution. The techniques developed were also used to measure the velocity field of an ejector. Author

N71-18662# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aerospace Research Labs.
ON THE DETERMINATION OF OPTIMUM THRUST NOZZLE OF A GIVEN LENGTH FOR A FLOW WITH SWIRL: NUMERICAL RESULTS Final Report
Karl G. Guderley and Mark C. Breiter Sep. 1970 32 p refs
(AD-715902; ARL-70-0161) Avail: NTIS CSCL 20/4

In a previous report with the same title (AD-631313) the theory of optimum thrust nozzle of prescribed length in a flow with swirl around the axis of symmetry was presented. In the present report the formulae for the computation are summarized, the computational procedure is prescribed in some detail and a number of examples are shown. For the swirl the assumption is made that far upstream in the oncoming flow one has a solid body rotation. The results as far as they are of technical interest are summarized in graphs. They show nozzle shapes for different strengths of the initial swirl, and lines of maximum attainable nozzle effectiveness. The presence of swirl increases the nozzle effectiveness but the thrust is somewhat lower, since the swirl reduces the mass flow through the nozzle. The shape of optimum nozzles is nearly independent upon the swirl. Author (GRA)

N71-18743# Naval Postgraduate School, Monterey, Calif.
A CORRELATION BETWEEN FRICTION REDUCTION AND MOLECULAR SIZE FOR THE FLOW OF DILUTE AQUEOUS POLYETHYLENE-OXIDE SOLUTIONS IN PIPES
John Wesley Kinnier (Ph.D. Thesis) Jun. 1970 121 p refs
(AD-715556) Avail: NTIS CSCL 20/4

Pipe-friction factors for dilute aqueous polyethylene-oxide solutions in pipes of nominal diameters of 1/4, 3/8, and 3/4 in. were measured over a two decade range of Reynolds numbers. In the transition region, the amount of drag reduction is dependent upon polymer concentration and wall shear stress as well as Reynolds number. For high Reynolds numbers, where the wall shear stress was high compared to the critical value, no diameter effect was noted. Intrinsic viscosity measurements, made on samples withdrawn from pipe flow, provided direct evidence that polymer degradation take place under flow conditions. Spectrographic measurements indicated that this degradation is mechanical (and not chemical). The relative volume of solution occupied by polymer molecules (represented by the volume of equivalent hydrodynamic spheres) is shown to be a dominant parameter governing the drag-reduction phenomenon for polyethylene-oxide solutions in pipe flow. It is further shown that the equivalent volume ratio may be used to normalize the pipe friction factors for various concentrations of different molecular-weight species of polyethylene-oxide.
Author (GRA)

N71-18840# National Research Council of Canada, Ottawa, (Ontario).
BASIC HYDRODYNAMIC CHARACTERISTICS OF THE SPOUTING BED [OSNOVNYE GIDRODINAMICHESKIE KHARAKTERISTIKI FONTANIRUYUSHCHEGO SLOYA]
A. M. Nikolaev et al 1970 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Khim. i Khim. Teknol. (Moscow), v. 7, no. 5, 1964 p 855-857
(NRC-TT-1434) Avail: NTIS

Spouting processes were studied in a truncated cone with the wide base pointing upward. Beds of various heights with spherical particles of various grain size were used. The initial velocity of spouting depends on the dimensions of the particles, kinematic viscosity, the densities of the gas and particles, and the geometric dimensions of the column. A dimensionless equation for the initial velocity of spouting is presented.
F.O.S.

N71-18845# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
FLOODING IN STRATIFIED GAS LIQUID FLOW
Graham B. Wallis Aug. 1970 62 p refs
(Grant NSF GK-1841)
(Rept-27327-9) Avail: Issuing Activity

The results of a variety of theoretical and experimental studies on possible mechanisms for flooding in stratified gas-liquid flow are discussed and analyzed. Empirical data for vertical tubes and a horizontal rectangular duct are presented.
Author

N71-18859 Oklahoma Univ., Norman.
A VARIATIONAL FORMULATION OF TURBULENT COUETTE FLOW
Troy Dean Reed (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-2335

The first analytical solution for a turbulent, plane Couette flow has been obtained via application of the recently developed general evolution criterion of Glansdorff and Prigogine. The resulting theory indicates that the flow obeys the well-known law of the wall and enables the calculation of the constants appearing in the law as a function of Reynolds number. The theoretical results also include an approximate solution for the distributions across the flow of the Reynolds stress and the rate of dissipation of turbulent kinetic energy by viscous effects. In addition, a relation between the skin friction coefficient and Reynolds number is established.
Dissert. Abstr.

N71-18871 Tennessee Univ., Knoxville.
NON-SIMILAR MHD BOUNDARY LAYERS ON INSULATING WALLS
Louis George Hunter, Jr. (Ph.D. Thesis) 1969 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-2112

A numerical analysis of the flow field (inviscid core and boundary layer) which is typical of those found in a combustion driven supersonic MHD generator was carried out. The geometrical configuration analyzed was a semiinfinite plane channel with crossed electric and magnetic fields. The boundary layer gasdynamic and electromagnetic properties were studied under the following conditions: wall temperature variation, large applied magnetic field, Hall effect included or excluded, and stagnation pressure variation. In a large B field, separation occurs at a relatively short distance from the channel entrance. Separation occurs further upstream where the Hall effect is included, the wall temperature increased and where the loading factor and stagnation pressure are decreased.
Dissert. Abstr.

N71-18887# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
AN EXPERIMENTAL INVESTIGATION TO IMPROVE A JET MASS AUGMENTER BY MEANS OF A ROTATING INPUT
Kenneth Kaufman Nov. 1970 95 p refs
(Contract Nonr-1858-46)
(AD-715642) Avail: NTIS CSCL 20/4

The report is concerned with an experimental investigation of an air-to-air jet mass augmenter having a rotating primary flow input. Foa and Hohenemser have predicted that such a device should have a greater performance and a shorter mixing tube than a comparable normal jet augmenter. To determine the validity of this hypothesis, a jet augmenter having a constant area mixing tube and a connection for either a steady or a rotating primary flow nozzle was built and tested. The three rotating primary flow nozzles had geometric spin angles of 0 (steady), 10, and 20 deg from the thrust axis; the coning angle of each was 10 deg. For each experimental configuration, the effect on the agumentation properties and efficiency produced by varying the primary to secondary flow stagnation pressure ratio and the exit plane (back) pressure was determined. The resulting performance of the various augmenters was then compared. Results of the tests show moderate increases in performance for the rotating jet augmenter over the non-rotating. There is a preferred primary flow spin angle yielding the maximum performance for a given geometric configuration; the 10 deg spin angle nozzle gave the best results in these tests. Static pressures measured along the mixing tube wall indicate that the rotating augmenter can operate with a mixing tube length to diameter ratio about 60% less than that of a steady augmenter. Reasons for the performance are discussed.
Author (GRA)

N71-18917 California Inst. of Tech., Pasadena.
MASS SPECTROMETRIC STUDIES OF IONIZATION PRECURSORS AHEAD OF STRONG SHOCK WAVES
William McKinley Robinson, Jr. (Ph.D. thesis) 1969 135 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-1424

The nature and origin of precursor ions produced by photoionization ahead of strong shock waves in xenon are studied. A magnetic mass spectrometer is mounted at the end of a hydrogen-driven shock tube. Ions produced upstream of a shock wave are sampled by the spectrometer and the collected current provides a continuous time history of a particular ionic species. A mass spectrum is obtained in the precursor region for all impurities found in the shock tube. In all the conditions studied, the dominant ion present in the precursor is Xe(+), although in certain instances, the impurity ion currents are found to be of the same order of magnitude as the xenon ion current. For small impurity levels, photoionization processes in xenon and impurities are apparently independent.
Dissert. Abstr.

N71-18918 Alabama Univ., Huntsville.
AN INVESTIGATION OF TWO PHASE FLOW THROUGH POROUS MEDIA
James Leonard Evers (Ph.D. Thesis) 1969 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 70-1378

Porous beds, rendered transparent by matching the index of refraction of the liquid phase to that of the solid particles comprising the beds, are employed in the investigation of two phase flow through porous media. Formulated are parameters that can be used to predict the flow conditions of a gas-liquid mixture under an arbitrary condition of gravity. The shapes of the gas-liquid interfaces are determined by photographing the flow at very high frame speeds (e.g., 5000 frames per second) and viewing the resulting film at normal projector speeds. From these determinations a phenomenological description of the flow is proposed which accounts for the dominant forces existing between the solid-gas-liquid components. Dissert. Abstr.

N71-18932 California Univ., Los Angeles.
HORIZONTAL BOUNDARY LAYERS IN DENSITY STRATIFIED FLOWS
Larry George Redekopp (Ph.D. Thesis) 1969 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 70-2248

Two fundamental parameters, the Reynolds number and the Russell number are basic to a description of the flow above a horizontal surface. It is shown that the relative magnitude of these parameters plays a vital role in determining the structure of the flow. Analysis based on the Boussinesq approximation and the neglect of density diffusion demonstrates that four different flow regimes can be defined. A description of the flow field for each of the parameter classifications is developed and some speculative applications are discussed. Dissert. Abstr.

N71-18933 Texas Technological Coll., Lubbock.
THE EFFECT OF TRANSVERSE TEMPERATURE GRADIENTS ON THE VELOCITY AND TEMPERATURE PROFILES FOR LAMINAR FLOW OF AIR
Gerald Simmons Kirby (Ph.D. Thesis) 1969 238 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 70-1475

The steady laminar flow in a circular tube of a radiation nonreacting gas under the influence of large radial temperature gradients is investigated experimentally. The wall temperature is uniform and the entering gas is hydrodynamically fully developed and isothermal. Measurements are restricted to the thermal entrance region where large variations of fluid properties occur. The entrance Reynolds number has a range from 930 to 2192 and wall to local bulk temperature ratios of up to 2.2 are obtained. Measurements of temperature and axial velocity profiles of various axial positions are obtained by traversing an impact tube and thermocouple probe across the flow stream. Radial velocity profiles are obtained by utilizing the conservation of mass principle and integrated profile data. The existence of a contributory radial velocity component is verified. Dissert. Abstr.

N71-18936 Rensselaer Polytechnic Inst., Troy, N.Y.
STUDIES IN RAREFIED GAS DYNAMICS: A. LOW DENSITY HYPERSONIC FLOW OVER A CONE. B. SCATTERING OF GAS PARTICLES FROM A SOLID SURFACE
Robert Hofland, Jr. (Ph.D. Thesis) 1969 245 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.20 Order No. 70-2621

An experimental and analytical study was conducted in order to understand the mechanism involved in the breakdown of classical, thin boundary layer theory and of continuum concepts in rarefied gas dynamics. In the experimental work, static-pressure distributions were measured on a 10 deg semi-vertex angle cone that was placed in air and helium hypersonic flows of varying degrees of rarefaction. The measurements encompass the domain between the weak viscous-interaction and kinetic regimes. A simple model for the interaction of thermal-energy gas particles with a solid surface, from which absorbed gases have been removed was investigated. Conventional statistical methods are applied to the model to find the velocity distribution function of reflected particles in terms of the parameters of the problem. Dissert. Abstr.

N71-18939*# National Aeronautics and Space Administration, Washington, D.C.
PROPAGATION OF DISTURBANCES IN VISCOUS HYPERSONIC FLOWS [RASPROSTRANENIYE VOZMUSCHENIYE V VYAZKIKH GIPERZVUKOVYKH TECHENIYAKH]
V. V. Mikhaylov et al Mar. 1971 25 p refs Transl. into ENGLISH from the Russian
(NASA-TT-F-13485) Avail: NTIS CSCL 20D

Viscous hypersonic flows of a perfect gas are considered on the basis of the boundary layer-inviscid flow interaction theory. It is shown that if this interaction is not weak, the upstream influence of some variation in the boundary conditions reaches the leading edge of a body in all cases. Mathematically, this effect is equivalent to the nonunique expansion of the solution at a sharp leading edge and leads to the eigensolution problem. These solutions are analyzed for some cases of plane flow and three-dimensional flow field around a triangular plate at zero incidence. The problem of incipient boundary layer separation and its development on a smooth surface is discussed. Author

N71-18940*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LINEARIZED THEORY OF STAGNATION REGION SKIN FRICTION AND MASS TRANSFER AT HYPERSONIC SPEEDS
Kenneth K. Yoshikawa Washington Mar. 1971 29 p refs
(NASA-TN-D-6262; A-3677) Avail: NTIS CSCL 20D

A linearized theory for stagnation region heat and mass transfer has been extended to include the shear stress. The method considers the momentum and energy equations which are uncoupled first and then linearized by the introduction of the effective values for the thermal and transport properties. Solutions of these equations are applicable at very high speeds, where conduction and shear stress in the shock layer and the interaction between the heated gas behind the shock wave and the injected or ablated gases must be considered. An explicit closed-form first-order solution has been obtained for the compressible, viscous shock-layer momentum equation with mass addition or suction. Results of this analysis show that the effect of gas injection on shear gradient (skin friction) near the stagnation point strongly depends on the Stanton number without mass addition, wall temperature, relative injectant molecular weights, and the ratio of the averaged Peclet number between the free-stream and injected gases. The solution is substantiated by comparisons with exact solutions. Author

N71-18943# Los Alamos Scientific Lab., N.Mex.
ENERGY INEQUALITIES IN SOME NONLINEAR INITIAL-VALUE PROBLEMS
Burton Wendroff (Denver Univ.) Aug. 1970 14 p refs
(Contract W-7405-eng-36)
(LA-4525) Avail: NTIS

Energy estimates and a uniqueness theorem are derived for systems of equations of a positive-definite matrix. Discrete and semidiscrete schemes are also discussed. It is noted that the equations of compressible flow can be put in this form, although in that case the matrix is only semi-definite. Author (NSA)

N71-18948 Stanford Univ., Calif.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: AN EXPERIMENTAL STUDY OF THE EFFECTS OF A FAVORABLE PRESSURE GRADIENT
Howard Lindsay Julien (Ph.D. Thesis) 1969 194 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 70-1555

Mean velocity profile data are reported for blown, unblown, and sucked accelerated boundary layers. The pressure gradients investigated are those corresponding to constant values of the pressure gradient parameter K. The three values of K considered are 0.57×0.000001, 0.77×0.000001, and 1.45×0.000001. For each pressure gradient, the surface boundary conditions cover a range of constant blowing and sucking fractions from F = -0.004 to 0.006. The friction factor was found to be decreased by the imposed acceleration for suction, whereas for blowing an increase was indicated. Velocity profiles corresponding to these accelerated flows were found to deivate from those characteristic of zero pressure gradient flows. These deviations in the fully turbulent and wake regions of the boundary layer apply over the range of blowing and sucking fractions investigated. Dissert. Abstr.

N71-18962*# Aerojet-General Corp., Sacramento, Calif. Nuclear Systems.
WATER DROPLET SIZE DETERMINATION FOR BREAKUP OF LARGE DIAMETER JETS
May 1970 153 p refs
(Contract SNP-1)
(NASA-CR-116820; FAC-FTR01-W224-3; ANSC-1) Avail: NTIS CSCL 20D

The drops generated by the breakup of water jets from nozzles ranging in diameter from 0.25 to 1.5 in. were photographed in a series of wind tunnel tests. The volume mean drop size generated in these tests compared favorably with that calculated using the empirical equation generated by Ingebo for nozzles from 0.01 to 0.04-in. in diameter. An empirical expression is presented that characterizes the water-jet mass distribution in a cross flow of gas. A series of tests of flat spray nozzles indicates that the penetration is decreased to 50 to 60% of that attained with a penetration or fire-hose nozzle. Author (NSA)

N71-18983# Argonne National Lab., Ill.
KINETICS OF MASS TRANSFER IN THE VIBRATORY MOTION OF A SOLID BODY IN A STREAM OF LIQUID [KINETIKA MASSOBMENA PRI KOLEBATELNOM DVIZHENII TVERDOGO TELA V POTOKE ZHIDKOSTI]
I. N. Fiklismov et al Sep. 1970 9 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh., Akad. Nauk Belorussk. SSR (Minsk), v. 7, no. 1, 1964 p 45-48
(PB-194294T; ANL-TRANS-648) Avail: NTIS CSCL 20D

The kinetics of mass transfer in a solid-liquid system was studied under conditions where the influence of liquid motion relative to the particles is combined with that of the oscillation of the latter. A considerable influence by the oscillating motion of the solid particles on the kinetics of mass transfer was established. Criterial equations were obtained to evaluate this effect. Author (GRA)

N71-18984 California Univ., Los Angeles.
A THEORETICAL STUDY OF INVISCID, SUPERSONIC FLOW ALONG A CORNER FORMED BY THE INTERSECTION OF TWO WEDGES
Thomas Parker Goebel (Ph.D. Thesis) 1969 227 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 70-2208

The study is restricted to symmetric cases in which the flow has a plane of symmetry making equal angles with the two wedges. The resulting flow field is conical. Far from the corner, a plane shock sheet is attached to either wedge. Experiments have shown that near the corner, the two plane shocks interact, resulting in a well-defined but complex structure. The numerical iteration scheme proceeds as follows: The observed wave structure is idealized so as to conserve some gross features of the interaction and to satisfy jump conditions across all discontinuities in terms of a finite number of parameters (two degrees of freedom were used in this analysis). Integrations inward from the assumed shock boundaries toward the corner are repeated for various values of the free parameters until selected boundary and matching conditions are satisfied. Dissert. Abstr.

N71-18985 Tennessee Univ., Knoxville.
AN EXPERIMENTAL INVESTIGATION OF THE TURBULENT AND MEAN FLOW PROPERTIES OF A PLANE TWO DIMENSIONAL TURBULENT WALLJET
Jackson Lee Nelson (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-2128

Profiles of the streamwise component of the mean velocity and the non-zero components of the Reynolds stress tensor were measured at several downstream locations in a two-dimensional plane turbulent wall jet by means of a constant-temperature hot-wire anemometer. A mean momentum balance calculated from the universal functions was relatively well satisfied in the interior region of the jet. Most of the terms (those which were obtainable from the universal functions) in the total and the turbulent energy balances were computed. The turbulent energy balance indicated that the convective diffusion by turbulence of the total turbulent energy is an important contribution to the transport of turbulent energy. Dissert. Abstr.

N71-18986 Illinois Univ., Urbana.
NUMERICAL STUDIES OF SOLUTIONS OF THE BOLTZMANN TRANSPORT EQUATIONS FOR RAREFIED GAS FLOW PROBLEMS
Kenneth Raymond Roth (Ph.D. Thesis) 1969 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 70-962

Detailed accuracy studies were made of two solutions of the Boltzmann transport equations for the flow of heat between parallel plates in a rarefied gas and of two solutions of the Boltzmann transport equations for the plane shock wave. The solutions investigated were for the 4-moment and 5-moment heat flow problems and the Mott-Smith and 6-moment shock wave problems. Several significant findings have been obtained from the comparative studies of the heat flow solutions. The overall effect of interchanging the molecular interaction model from rigid elastic spheres to Maxwellian molecules is very small. The effect of increasing the number of parameters in the moment method from four to five is small on the distribution function and the collision integral but is significant on certain moments of the distribution function. Dissert. Abstr.

N71-18989 Syracuse Univ., N.Y.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE STABILITY OF PIPE FLOW WITH RESPECT TO THREE-DIMENSIONAL DISTURBANCES
Thomas Michael Houlihan (Ph.D. Thesis) 1969 66 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 70-1955

The stability of fully developed laminar flow in a circular pipe, perturbed by an infinitesimal three-dimensional helical disturbances is presented. A method analogous to the classical boundary layer study of Tollmien has been followed in the analysis. This yielded a neutral stability curve which, while unlike the classical hairpin result, nevertheless could conceivably describe pipe

flow instability. Preliminary results of experiments in a carefully constructed wind-tunnel facility are presented for flow in a 1.25 in. diameter pipe at a Reynolds number of order 12,000. It was verified that the flow was quite stable to axisymmetric disturbances. But more significantly it was shown that a point source form of helical disturbance did seem to grow with a wavelength predicted by the theory for the given test Reynolds number. Author

N71-18990*# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.

CHARACTERISTICS OF SEPARATED FLOW REGIONS WITHIN ALTITUDE COMPENSATING NOZZLES Final Report

Thomas J. Mueller, Wayne P. Sule, and Charles R. Hall, Jr. Jan. 1971 141 p refs

(Contract NSR-15-004-029)

(NASA-CR-116875; UNDAS-TN-029-FR-9) Avail: NTIS CSCL 20D

Results of an experimental and analytical investigation of the characteristics of separated flow regions within altitude compensating nozzles are presented. Experimental results for a planar and an axisymmetric truncated plug nozzle are included while analytical results for planar and axisymmetric truncated plug and expansion-deflection nozzles are presented. The experimental results include extensive optical and pressure data covering nozzle operating characteristics, diffuser effects, sonic line shape, lip shock strength, turbulence effects and nozzle flow development. The extension of the analytical method of Mueller and Hall to included nonuniform nozzle flows produced the correct base pressure trends with overall nozzle area ratio, base temperature ratio, ambient pressure ratio, amount of base bleed, and initial boundary layer thickness as well as good qualitative agreement between the experimental and analytical flow fields when no strong internal shock was present. It was found that the lip shock was not of significant strength in the cases studied to warrant including it in the theory. Also it was found that the sonic line shape was noticeably distorted and that the separated free shear layer was turbulent under all conditions studied. Author

N71-19020 Minnesota Univ., Minneapolis.

MATHEMATICAL CONNECTION BETWEEN SOLUTIONS OF THE NAVIER-STOKES SYSTEM AND THE PRANDTL BOUNDARY LAYER SYSTEM

Simiha S. Tadros Ibrahim (Ph.D. Thesis) 1969 66 p

Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 70-1826

Some a priori assumptions on the solutions of the Navier-Stokes system are made to guarantee laminarity, favorable pressure gradient, and smooth given data to define this class of solutions. Then, an associated Prandtl solution is constructed in such a way that the initial velocity is close to the initial velocity profile within this given class. Assuming that the pressure gradient is close to the correct pressure gradient on the wall, it is shown that the two solutions are asymptotically valid in a boundary layer as the Reynolds number tends to infinity. The Crocco transformation is applied to simplify the equations for the two systems. The proof involves an argument based on the maximum principle for elliptic-parabolic equations. Dissert. Abstr.

N71-19042# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

TURBULENT PLUME IN A LAMINAR CROSS FLOW

D. P. Hoult and J. C. Weil Oct. 1970 33 p refs Sponsored by the US Public Health Service

(PUBL-70-8) Avail: Issuing Activity

A simple entrainment hypothesis to explain the rise and growth of a turbulent plume in a laminar cross flow is presented. The entrainment rate is assumed proportional to the plume perimeter and the tangential and normal velocity differences between the plume and the surrounding fluid. Because a linear combination of the entrainment due to each velocity difference is assumed, two constants of proportionality or entrainment parameters are introduced in the model. Sources of momentum, buoyancy or combinations of the two are accounted for by the theory. Superposition of the two entrainment effects was verified by experiments on pure jets in a cross flow. Author

N71-19090# Catholic Univ. of America, Washington, D.C. Dept. of Space Science and Applied Physics.

EXPERIMENTAL INVESTIGATION OF THE STABILITY OF TWO-LAYERED COCURRENT FLOW

Cheol Park and Timothy W. Kao Jun. 1970 118 p refs

(Grant NSF GK-2639)

(Rept-70-006) Avail: Issuing Activity

The stability of a rectangular channel flow of two fluids, oil and water, was investigated experimentally, with and without artificial excitation. All the measurements for shear waves were made in the water phase by using anemometers with hot-film probes, and measurements for the interfacial disturbances at the interface were made with a wave gauge. The critical water Reynolds number, based upon the hydraulic diameter of the channel and the superficial velocity defined by the ratio of flow-rate of water to total cross-sectional area of the channel, was found to be 2,300. Behavior of damped and growing shear waves, using artificial excitation, was examined in detail. Mean flow profiles, amplitude distributions of disturbances, amplification rate, wave speed, and wave number ware obtained. A neutral stability boundary in the wave number-water Reynolds number plane was also obtained experimentally. It was found that, in natural transition, the interfacial mode was not excited. The first appearance of interfacial waves was a manifestation of the shear waves. The role of the interface at the transition range from laminar to turbulent flow was to introduce and enhance spanwise oscillation in the water phase and to hasten the process of breakdown for growing disturbances. Author

N71-19091# Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.

INFILTRATION AFFECTED BY FLOW OF AIR

David B. McWhorter (Ph.D. Thesis) Mar. 1971 140 p refs

(Grant NSF G-2698)

(AED70-71DBMc28) Avail: Issuing Activity

The equations which describe the simultaneous flow of two immiscible fluids in a porous medium are presented as well as the determination of criteria for the construction of similar physical systems. Attention is focused on similitude of systems in which an incompressible wetting fluid displaces a compressible nonwetting phase. Five criteria for similitude are recognized and discussed. Approximate analytical solutions to the infiltration problem for several boundary conditions are given. Experimental data for the infiltration into finite media are presented and discussed. Measurements of the developing capillary pressure profile during constant rate infiltration were made. An approximate analytical solution to the constant rate infiltration problem elucidates the factors which affect the time at which ponding occurs. Author

N71-19126 Syracuse Univ., N.Y.

FORMATION AND FLOW CHARACTERISTICS OF AN IMPULSIVELY GENERATED VORTEX STREET

Jeffrey Allen Asher (Ph.D. Thesis) 1969 153 p

Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-1938

In this shock tube investigation, the passage of a plane normal shock wave and its associated flow over a two-dimensional circular cylinder impulsively generated a vortex street. The movement of the initial vortex pair was significantly altered for R > 100,000, where the generation of secondary vortex pairs were

observed. The initial and secondary vortex pairs merged well before shedding commenced. During the lifetime of the impulsively generated wake, the Strouhal number, S, approached an average value of 0.16 which is significantly lower than the usual steady state value of about S = 0.20. Spacing ratios were found to decrease with increasing vortex street lifetime at a given downstream location. The space and time variations of vortex circulation were deduced from interferometric data. In several cases the lift and drag coefficients were determined and found to be time dependent. Dissert. Abstr.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-18219# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

VALIDITY AND INTERPRETATION OF C 14 AGES [VALIDITE ET INTERPRETATION DES AGES C 14]

G. Delibrias 1970 18 p refs In FRENCH Presented at meeting on Stratigraphy Methods and Tendencies, Orsay, France, 12–14 Oct. 1970

(CEA-CONF-1618; CONF-701008-1) Avail: AEC Depository Libraries

The chief known causes of error likely to affect ages determined by the carbon-14 method are listed. Special attention is paid to the consequences: first, of variations with time of the C-14/C-12 ratio, which seem be bound up with changes in the strength of the earth's magnetic field and lead to an underestimation of up to 800 years of ages of 6000 years; and second, of isotopic effects and pollutions which change the initial carbon ratio C-14/C-12 of the samples. The age errors caused by these various contaminations are worked out as a function of their magnitude. In addition, although the value 5,568 years is used for the half-life of C-14, a recent determination gave the average value as 5,730 + or − 40 years and this must be taken into account. Author (NSA)

N71-18242# New York Univ., N.Y. Bronx Lab. for Electroscience Research.

CONTOUR MAP AND TERRAIN INTERVISIBILITY PROCESSING: A LITERATURE SURVEY

Hans J. Breme Jul. 1970 40 p refs

(Grant AF-AFOSR-1854-70)

(AD-715311; TR-403-11; AFOSR-70-2605TR) Avail: NTIS CSCI B/2

The report is a survey of research done on terrain representation and intervisibility. The computer processing of contour maps and other terrain representation for visibility calculation is emphasized. General topographic information processing is also included. The report consists of a discussion of the research and an annotated bibliography. Author (GRA)

N71-18253# Coast Guard, Washington, D.C.

ABSTRACT OF PROCEEDINGS, HAZARDOUS POLLUTING SUBSTANCES SYMPOSIUM: ANNEX 1 TO STUDY ON CONTROL OF HAZARDOUS POLLUTING SUBSTANCES Final Report

[1970] 555 p refs Conf held at New Orleans, 14–16 Sep. 1970

(PB-195342; USCG-HPS-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 13B

A symposium was held with its principal objective being the solicitation of the views of industry, academic leaders, conservationists, state governments and other non-federal government spokesmen on the identification and response to the uncontrolled release of hazardous polluting substances into the navigable waters of the United States. The symposium employed a panel format encompassing three areas: (1) definition and classification; (2) prevention, detection and removal; and (3) legal and economic factors. Abstracts of the comments made by some 400 interested parties are included, along with the recommendations made by each panel. Author (GRA)

N71-18283# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

SCAVENGING IN PERSPECTIVE

J. J. Fuquay 14 Jul. 1970 11 p refs Presented at Precipitation Scavenging Meeting, Richland, Wash., 2–4 Jun. 1970

Contract AT(45-1)-1830)

(BNWL-SA-3450; CONF-700601-2) Avail: NTIS

Mechanisms of precipitation scavenging in the atmosphere are reviewed. It is noted that precipitation scavenging is usually thought of as being in major divisions including transport of the material to the scavenging site, in-cloud scavenging and precipitation, and below-cloud scavenging by the precipitation. Discussions are included concerning various metallic and nonmetallic pollutants. NSA

N71-18282# Atomic Weapons Research Establishment, Aldermaston (England).

SOME SEISMIC RESULTS OF THE MILROW UNDERGROUND NUCLEAR EXPLOSION

P. D. Marshall, D. J. Corbishley, and P. G. Gibbs Aug. 1970 16 p refs

(AWRE-O-47/70) Avail: AEC Depository Libraries; HMSO 2s 6d; BIS $0.60

A large yield nuclear device was detonated underground on Amchitka Island in the Aleutians and recorded at four arrays. The preliminary results from the four short period arrays and the analysis of the surface wave train from the device and from an earthquake in the Aleutian Isles are presented. The JED technique for epicenter location and the results of spike filtering the short period signal to identify the free surface reflection pP waves are also presented. Author (NSA)

N71-18296# Argonne National Lab., Ill.

MULTIPLE-SOURCE URBAN ATMOSPHERIC DISPERSION MODEL. CHICAGO AIR POLLUTION SYSTEMS ANALYSIS PROGRAM

J. J. Roberts, E. J. Croke, A. S. Kennedy, J. E. Norco, and L. A. Conley May 1970 148 p refs Prepared in cooperation with Chicago Dept. of Environ. Control and Natl. Air Pollution Control Admin., Washington, D.C.

(Contract W-7405-eng-38)

(ANL-ES-CC-7) Avail: NTIS

A multiple-source, urban atmospheric dispersion model was developed which describes transients such as morning transitions in atmospheric stability and mixing layer height. The dispersion model was validated by comparison with over 10,000 hourly averages of sulfur dioxide monitored by the City of Chicago. For example, the model accounts for 50% of the variance in 6-hr averages of observed data and 70% of the variance in 24-hr averages. Of particular significance, is the capability of the model to describe area sources as volumetric clouds of pollutant and to evaluate the effect of these sources on dose points within, as well as external to, the area. The atmospheric transport kernel in the model describes the instantaneous release (delta function) of pollutant, advection according to piecewise constant hourly wind vectors, and Gaussian diffusion about the centroid. Continuous plumes are simulated by integration in time of this point-source Green's function. The

transport theory and all other computerized algorithms that influence the dispersion problem are described and statistical results of extensive validation studies are presented. Author (NSA)

N71-18306# Hawaii Inst. of Geophysics, Honolulu.
SEISMOLOGICAL BULLETIN: NORTHWESTERN PACIFIC ISLANDS STATIONS, 1967–1968
George H. Sutton and Daniel A. Walker Jan. 1970 26 p
(Grants NSF GA-1255; NSF GA-12851)
(PB-195627; HIG-70-3; DR-15) Avail: NTIS CSCL 08K

Seismological data reported from the northwestern Pacific Island seismological stations are tabulated. GRA

N71-18307# Stanford Research Inst., Irvine, Calif.
THE BIOSPHERE AS A POSSIBLE SINK FOR CARBON MONOXIDE EMITTED TO THE ATMOSPHERE Final Report
Elaine A. Levy May 1970 37 p refs
(Contract PHS-CPA-22-69-43)
(PB-195433) Avail: NTIS CSCL 06C

The possibility was investigated of certain elements in the biosphere serving as sinks for carbon monoxide emitted to the atmosphere by various human activities. This was accomplished by exposing test samples to 100 ppm carbon monoxide (static experiments). Author (GRA)

N71-18317# Hawaii Inst. of Geophysics, Honolulu.
THE GEOLOGY OF ANTARCTICA
George P. Woollard Jan. 1970 124 p refs
(PB-195633; HIG-70-8) Avail: NTIS CSCL 08G

Contents: Tectonic setting of Antarctica; Basic tectonic divisions of Antarctica; The bedrock topography of Antarctica; The crystalline basement rock surface; Crustal structure in Antarctica; Seismic refraction studies of the upper crust; Crustal structure in Scotia Sea area; Crustal thickness in Antarctica; General remarks on surface geology of Antarctica; Radioactive ages in Antarctica; Recent concepts concerning the geology of Antarctica; The geology of the Antarctica Peninsula-Scotia Arc area; The sedimentary record in east Antarctica; Paleozoic structural lineations in Antarctica; Recapitulation and summary on geologic history of Antarctica. GRA

N71-18334# New York Univ., N.Y. Dept. of Biology.
AERIAL PHOTOGRAPHIC STUDIES OF THE COASTAL WATERS OF NEW YORK AND LONG ISLAND
Mahlon G. Kelly and Louis Castiglione 12 Nov. 1970 76 p refs Original contains color illustrations
(Contract N62306-70-A-0073-0003)
(AD-715804) Avail: NTIS CSCL 8/1

Contents: Aerial photography; (Data acquisition, Comparison of color photography, Exposure, Multispectral photography, Depth penetration, Altitude differences); Photoenhancement; (Video enhancement, Photographic enhancement process, Imaging microdensitometry, Color separation); Field studies of water characteristics; Photointerpretation of benthic materials. GRA

N71-18335# Washington Univ., Seattle. Div. of Marine Resources.
ARCTIC ICE DYNAMICS JOINT EXPERIMENT: THEORETICAL DISCUSSIONS
Joseph O. Fletcher and Alma Johnson Oct. 1970 75 p refs
(PB-195636; AIDJEX-Bull-2) Avail: NTIS CSCL 08L

Contents: the kinematics and mechanical behavior of pack ice; the state of the subject; latest experiments with ice rheology, notes on a possible constitutive law for Arctic Sea ice; thoughts on a viscous model for sea ice; the pressure term in the constitutive law of an ice pack; a study of ice dynamics relevant to AIDJEX; techniques for measuring strain rate; power spectrum analysis of ice ridges. GRA

N71-18346# St. Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
RESEARCH IN SEISMOLOGY Annual Technical Report No. 1, 1 Sep. 1969–31 Aug. 1970
Carl Kisslinger 1 Sep. 1970 213 p refs
(Contract F19628-70-C-0036; ARPA Order 0292)
(AD-715934; AFCRL-70-0582) Avail: NTIS CSCL 8/11

Research related to the detection, location, and identification of underground nuclear explosion devoted to several major problem areas has been completed. Effects of earth structure and focal mechanism on body-wave magnitude determinations have been investigated, and empirical relations between nuclear yield and Rayleigh wave magnitudes established for selected seismograph stations. Calculations of crustal transmission coefficients for P-waves have been extended to take into account dip and the results applied to observations of laboratory explosion and deep earthquakes. A model for the triggering of earthquakes by explosions based on finite-strain theory has been suggested, the superposition of the explosion-generated and triggered-earthquake-generated P-wave computed for single models, and aftershocks of the Benham event analyzed. Methods of using P-wave and Rayleigh wave spectra for determining earthquake mechanisms have been developed and applied. A small local network for detecting and locating low magnitude earthquakes in southeast Missouri has yielded good data on current local seismicity. Author (GRA)

N71-18349# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
AN EXAMINATION OF THE EXPONENTIAL POWER LAW IN THE SURFACE BOUNDARY LAYER
Frank V. Hansen Sep. 1970 38 p refs
(AD-715349; ECOM-5326) Avail: NTIS CSCL 4/1

The exponential power law is examined in relation to the diabatic and log plus linear profile formulae of similarity theory. The dependence of the exponent of the power law on height, surface roughness, wind speed and season of the year is pointed out. It is concluded that the exponential power law is a marginal method for prediction of the wind profile in the surface boundary layer. Author (GRA)

N71-18351# Hawaii Inst. of Geophysics, Honolulu.
TOWARD EVALUATION OF PLANETARY SEICHES BY NUMERICAL TECHNIQUES
Niels Christensen, Jr. and Gordon W. Groves May 1970 72 p refs
(Grant NSF GP-4254)
(PB-195623; HIG-70-9) Avail: NTIS CSCL 08C

Planetary seiche solutions in the continuous case have been determined for some simple basins by approximations, notably, nondivergence and the beta-plane approximation. If these approximations are not made, the differential equations governing this type of motion become very complicated. Numerical methods can be applied to more complicated formulations of the discretized version of this problem (i.e., divergent spherical coordinates) and to study planetary seiches. When the motion is allowed to be divergent (free-surface boundary) there are also gravity wave solutions. Author (GRA)

N71-18352# Hawaii Inst. of Geophysics, Honolulu.
USE OF ORTHOGONAL FUNCTIONS FOR THE ANALYSIS, PREDICTION, AND STUDY OF THE TIDE
Gordon W. Groves May 1970 55 p refs
(Grants NSF GA-1117; NSF GA-17137)
(PB-195620; HIG-70-13) Avail: NTIS CSCL 08C

A linear analysis was made of the sea surface tide record at Hilo, Hawaii. This location was chosen because the data were available on magnetic tape and the record is about as linear as any that could be obtained anywhere. A series of orthotides were generated for the combined diurnal and semidiurnal second degree

gravitational tide for the case tau = 0. These were correlated with about a month of the Hilo record to evaluate the orthotide constants. Author (GRA)

N71-18353# Hawaii Inst. of Geophysics, Honolulu.
PALEOMAGNETIC INVESTIGATIONS OF DEEP BORINGS ON THE EWA PLAIN, OAHU, HAWAII
Stephen R. Hammond (M.S. Thesis) May 1970 68 p refs
(PB-195634; HIG-70-10) Avail: NTIS CSCL 08G

Two core holes were drilled on the coastal plain near Oahu, Hawaii. Both holes penetrated the entire sequence of reef and near-shore deposits and ended in basalt. The holes were 1107 and 544 feet deep, respectively, and core recovery was about 85 percent. In order to study the cores, a 5 Hz spinner magnetometer and an alternating current demagnetizer were assembled and calibrated. In addition to a stratigraphic polarity sequence, which is presented for each core, the dominant sampled lithology was determined to be a largely unaltered coralline, skeletal, micritic limestone containing detrital (titano)maghemite as the principal magnetic mineral. Author (GRA)

N71-18354# South Dakota State Univ., Brookings. Remote Sensing Inst.
REMOTE SENSING OF HYDROLOGIC RESOURCES IN THE GREAT PLAINS Final Report
F. A. Waltz and V. I. Myers Jun. 1970 108 p refs
(Contract DI-14-08-0001-G-25)
(PB-195451; USGS-DO-70-009; USGS-202; Rept-1) Avail: NTIS CSCL 08H

The feasibility of a data handling system for measuring and disseminating cropland soil moisture information from ERTS spacecraft data was studied. Large significant correlations were found between optical density measured on aerial film and soil water content measured by neutron probe methods, also between ground temperatures as measured through infrared thermal scanner techniques and soil water content of fallow or bare soil. Least square analyses of variance indicated crops, days and the interaction of crops by days as highly significant sources of variation in the data and the need for an absolute reference in conjunction with aerial data. It has been concluded that not only soil water content but plant water content and available soil water must be measured. Author (GRA)

N71-18402*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
MULTI-SPECTRAL AND THERMAL SCANNER EXPERIMENTS ALONG THE MASSACHUSETTS COASTLINE Final Report
A. C. Conrod Apr. 1970 12 p
(Contract NAS12-2213)
(NASA-CR-116782; RN-64) Avail: NTIS CSCL 08J

Multispectral imagery was obtained for several coastal and other sites in eastern Massachusetts in the spring and summer of 1969. Color aerial photography and thermal infrared imagery were acquired for some of the sites simultaneously with the multispectral imagery. Results of the experiments are reported for a thermal mapper survey of Boston Harbor; photographic, multispectral and thermal images of Plum Island, Massachusetts, and multispectral coverage of a dye-tracing test outside of Boston Harbor. Author

N71-18404# Laboratoire d'Aerothermique de C.N.R.S., Bellevue (France).
EXPERIMENTAL METHOD FOR CLASSIFYING SOILS ACCORDING TO THEIR DEGREE OF FROST [METHODE EXPERIMENTALE DE CLASSEMENT DES SOLS SELON LEUR DEGRE DE GELIVITE]
J. Aguirre-Puente and A. Dupas Jun. 1970 55 p refs In FRENCH Prepared jointly with Lab. Central des Ponts et Chaussees (Rept-70-5) Avail: NTIS

An experimental method is presented for systematic study of the behavior of soils in frosty conditions, especially related to road construction. Soils can be classified according to a coefficient existing between swell and square root of the frost index. ESRO

N71-18405*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
DOUBLE PROBE MEASUREMENTS OF dc ELECTRIC FIELDS WITH THE INJUN 5 SATELLITE
David P. Cauffman and Donald A. Gurnett Jan. 1971 75 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144(f); NAS1-8150(f); Grant NGL-16-001-043(97) et al Contract N00014-68-A-0196-0003)
(NASA-CR-116791; Rept-71-4) Avail: NTIS CSCL 04A

At high latitudes convection electric fields greater than 30 mV/meter, and sometimes greater than 100 mV/meter, are frequently observed in the auroral zone. A common feature is the occurrence of abrupt reversals in the east-west convection velocity at auroral zone latitudes. For dusk-dawn local times, these reversals generally correspond to an east-west flow away from the sun on the high latitude side of the reversal and toward the sun on the low latitude side. Over the polar region above the auroral zone the convection velocity is usually 10 to 20 mV/meter, electric field perturbations are sometimes observed, corresponding to generally westward convection outside the plasmasphere. At high altitudes, above about 1500 km, over the auroral zone/polar cap regions irregular electric field noise with amplitudes from 10 to 30 mV/meter is consistently observed. Author

N71-18406*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CLOSED-LOOP IONOGRAM PROCESSOR FOR THE ANALYSIS OF TOPSIDE SOUNDER IONOGRAM FILMS (FILMCLIP)
Lawrence Colin, K. L. Chan, and R. Glen Madsen (Astrodata, Inc.) Washington Mar. 1971 21 p refs
(NASA-TN-D-6204; A-3715) Avail: NTIS CSCL 14B

An on-line, computer processing system for reducing topside ionograms to electron density profiles is described. This operational system permits the operator to utilize all available redundant information for data selection, comparison, correction, and verification. When discrepancies occur, reinterpretation and recomputation may be iterated until a self-consistent result is obtained. Examples of this closed-loop processing technique, essential for the analysis of ionograms collected at high altitudes, are shown. Development of a more sophisticated, accurate, and rapid system also is outlined. Author

N71-18470# Groupe de Recherches Ionospheriques, Paris (France).
THE DIRECTION OF STATIONARY PHASE IN AN ABSORBING MEDIUM
Owen Storey et al [1970] 9 p refs Translated into ENGLISH from Acad. des Sci. (Paris), Compt. Rend., Ser. B - Sci. Phys., v. 270, no. 4, 1970 p 301 - 304 In ENGLISH and FRENCH
(GRI/TP/95) Avail: NTIS

The general expression is given for the direction of stationary phase for a beam of waves in an absorbing medium, as a function of the following parameters that characterize the structure of the beam: the mean directions of the real and imaginary parts of the wave number vector; four coefficients that specify the correlations between the variations of these two directions around their mean values. Author (ESRO)

N71-18478# Mitre Corp., Bedford, Mass.
REAL-TIME CORRECTION OF WIDEBAND OBLIQUE HF PATHS

Bernard D. Perry Nov. 1970 43 p refs
(Contract F19628-68-C-0365)
(AD-715918; MTR-1905; ESD-TR-70-371) Avail: NTIS CSCL 17/2

Another in a series of experiments involving real-time correction of HF ionospheric paths has been completed. Computer-controlled, real-time correction for path distortions has been achieved over a set of one hop oblique paths in the eastern United States. This correction technique, which utilizes a simple open-loop measure-then-correct procedure, provides compensation which remains valid for time periods from a few seconds up to a minute depending on the stability of the ionosphere. Author (GRA)

N71-18501# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
ELECTROSTATIC VLF WAVES OBSERVED IN THE POLAR MAGNETOSPHERE Technical Report, Aug. 1969 –Jul. 1970
Donald A. McPherson and Harry C. Koons 15 Aug. 1970 36 p refs
(Contract F04701-70-C-0059)
(AD-715898; TR-0059(9220-02)-4; SAMSO-TR-70-393) Avail: NTIS CSCL 4/1

Broadband electrostatic emissions are detected by a VLF receiver aboard the satellite OV3-3 (1966-70A). Enhancements of the electric-field intensity in ten bandpass channels at frequencies between 400 Hz and 14.5 kHz are observed when the spacecraft passes over the south polar region at altitudes between 2500 and 4500 km (satellite apogee). The power spectral density of these emissions decreases approximately as the inverse fourth power of the observed frequency. The most interesting feature of these emissions is the range of invariant-magnetic-latitudes (INVL) over which they are observed. The low-latitude limit at which they are detected is typically 72 to 76 degrees INVL in local morning and 68 degrees INVL near midnight. This dependence suggests that these emissions occur on magnetic-field lines along which the polar wind flows. During geomagnetically active periods, electrostatic waves with a high-frequency cutoff between 1.3 and 3.9 kHz are also observed in this altitude range. These emissions occur at latitudes below the low-latitude limit of the polar-electrostatic waves and above the latitude of the plasmapause. Author (GRA)

N71-18502*# Stanford Univ., Calif. Radioscience Lab.
A STUDY OF POLAR SUBSTORM RELATED TRAVELING IONOSPHERIC DISTURBANCES BASED ON COLUMNAR ELECTRON CONTENT MEASUREMENTS
Michael J. Davis Aug. 1970 147 p refs
(Contract NAS5-10102; Grant NGR-05-020-001)
(NASA-CR-116784; SU-SEL-70-051; TR-12) Avail: NTIS CSCL 04A

The disturbances exhibit a diurnal variation in their direction of arrival at a midlatitude observing site, explained by an average source location in the evening sector of the auroral oval. It is possible to relate their occurance to the occurance of polar substorms and to determine the location of the source of individual disturbances. These disturbances are not generally observed to travel across the equator, explained on the basis of the high rate of damping of the disturbances in the neutral atmosphere which produce them. A possible source related to the westward traveling surges observed in auroras is discussed. Numerical results are obtained for the height range 200 to 600 km. considered. The effects of perturbations in loss and diffusion is shown to produce considerable changes in the perturbation in the ionization caused by internal atmospheric gravity waves; in particular, it results in a large depression of the perturbed electron concentration at high levels. The effect of atmospheric gravity waves on electron content is also considered. Author

N71-18503# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ICE THICKNESS OBSERVATIONS ALONG THE COAST OF EASTERN CANADA AND SOUTHERN GREENLAND
M. A. Bilello, R. E. Bates, and J. Riley Oct. 1970 61 p refs
(AD-715424; CRREL-SR-125) Avail: NTIS CSCL 8/12

Between 1943 and 1951 the U.S. Air Force, in cooperation with Canada and Denmark, made ice thickness measurements at 22 stations along the coasts of eastern Canada and southern Greenland and on nearby lakes and rivers. This report includes the thickness data (not previously published) as well as descriptions of surface conditions, snow depths and other information bearing on aircraft and ice surface transport operations. Greatest ice thicknesses ranged from 31 inches (Presque Isle, Maine) to 94 inches (Sondre Stromfjord, Greenland). Least thicknesses at the time of maximum ice ranged from 15 inches (Presque Isle) to 47 inches (Cape Dan, Greenland). The average number of days of ice cover is given for all stations. It ranged from around 100 days in southern Newfoundland to around 250 days in northern Baffin Island. Author (GRA)

N71-18524# European Space Research Inst., Frascati (Italy).
HYDROMAGNETIC WAVE COUPLING BETWEEN THE SOLAR WIND AND THE PLASMA SHEET
J. F. McKenzie Oct. 1970 24 p refs Submitted for publication
(ESRIN-IN-104) Avail: NTIS

The effects of the wave characteristics and the flow of the solar wind, along with those of the plasma sheet on resonant oscillations of the geomagnetic tail were estimated using a simple two dimensional model of the tail. The boundary conditions used allow long wavelength perturbations on the surface of the tail to be coupled with waves in the plasma sheet which can be driven unstable by the Kelvin-Helmholtz mechanism. With typical geomagnetic tail parameters the period of the unstable antisymmetric modes is approximately 9 minutes. Author (ESRO)

N71-18543# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PROCESSING A PARTIALLY COHERENT LARGE SEISMIC ARRAY FOR DISCRIMINATION
Richard T. Lacoss and Guy T. Kuster 27 Nov. 1970 52 p
(Contract F19628-70-C-0230; ARPA Order 512)
(AD-715917; TN-1970-30; ESD-TR-70-353) Avail: NTIS CSCL 17/10

A stochastic model has been proposed to characterize the teleseismic short period P-wave signal variations observed within a Large Aperture Seismic Array (LASA). The model asserts that, in the frequency domain, the received signal is equal to some average signal multiplied by a random gain and phase. Within a Montana LASA sub-array the mean value of the modulus squared of the random term can be roughly approximated by $1 + 0.18f$ squared, where f is frequency. For sensors drawn from the full LASA aperture the value is approximately $1 + 2.0f$ squared. An incoherent signal processing method, spectraforming, is introduced as a viable alternative to beamforming for obtaining spectral information at frequencies above about 1.0Hz. The spectraform is essentially the average power in sensors with a correction subtracted for background noise power contributions. It is demonstrated that although beamforming will give more noise rejection than spectraforming the latter can be superior in terms of output signals to noise ratio when input signal variations between sensors are large. Expressions have been obtained for the signal power spectral density expected from various modes of processing. Author (GRA)

N71-18553# Aerospace Corp., El Segundo, Calif. Lab. Operations
GRAVITY WAVE INTERACTION WITH A TRANSIENTLY

HEATED ATMOSPHERE Technical Report, Aug. 1969 – Feb. 1970

Yam T. Chiu 15 Nov. 1970 37 p refs
(Contract F04701-70-C-0059)
(AD-715930; TR-0059(6260-10)-2; SAMSO-TR-70-394) Avail: NTIS CSCL 4/1

The report investigates the propagation of internal atmosphere gravity waves in an atmosphere driven into vertical motion by transient heating related to geomagnetic storms. It is shown that wave amplification exists and favors the observation of large amplitude waves near the Brunt-Vaisala period (approx 1000-2000 sec) in the thermosphere during active times. Besides such local frequency selection, the existence of wave-energy enhancement implies that gravity waves not only contribute to the maintenance of the static upper atmosphere but also serve as a means of rapid energy transport from pole to equator during geomagnetically active times. A model of upper atmospheric response to transient heating is proposed and it is shown that the inclusion of these waves leads to an apparent increase in the dynamic heat diffusivity. Author (GRA)

N71-18592# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung fuer Weltraumphysik.
THE IONOSPHERIC ELECTRON CONTENT OVER OULU, FINLAND, USING EXPLORER 22 (S-66) SIGNALS AND THE FARADAY-DOPPLER HYBRID METHOD AND A COMPARISON WITH THE LINDAU RESULTS [BESTIMMUNG DES ELEKTRONENINHALTES DER IONOSPHAERE UEBER OULU/FINNLAND MIT HILFE DES SATELLITEN EXPLORER 22 (S-66) NACH DEM FARADAY-DOPPLER-HYBRID VERFAHREN UND VERGLEICH MIT LINDAUER ERGEBNISSEN]
Gerhard Schmidt and Antti Tauriainen Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Sep. 1970 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss. Prepared jointly with Oulu Univ.
(BMBW-FB-W-70-50) Avail: NTIS; ZLDI Munich: 7.80 DM

The ground receiving equipment for recording the 40 and 360 MHz signal Doppler effect of the Explorer 22 satellite is described. The equipment was installed at Oulu, Finland. A modified Faraday-Doppler-hybrid method for calculating the ionospheric electron content is presented. Author (ESRO)

N71-18609# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
ELECTRIC FIELDS AND THEIR EFFECTS IN THE IONOSPHERE
G. Haerendel Jul. 1970 58 p refs Presented at the Intern. Symp. on Solar Terrest. Phys., Leningrad, May 1970
(MPI/PAE-Extraterr-44/70) Avail: NTIS

A review of observational methods used to evaluate ionospheric and magnetospheric electric fields and their effects in the ionosphere is presented. The most significant results are discussed and several conclusions are made from the data on the electromagnetic coupling of ionosphere and magnetosphere and on the magnetospheric convection. ESRO

N71-18610# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
ION TEMPERATURE MEASUREMENTS IN A ROTATING MAGNETIC FIELD PINCH [MESURES DE TEMPERATURES IONIQUES DANS UNE STRICTION A CHAMP MAGNETIQUE TOURNANT]
A. Berney (Ph.D. Thesis – Ecole Polytechnique Federale de Lausanne) Jun. 1970 83 p refs In FRENCH; ENGLISH summary Sponsored by Le Fonds Natl. Suisse de la Rech. Sci.
(LRP-40/70) Avail: NTIS

Ion temperature measurements by means of Doppler line broadening in a rotating magnetic field pinch experiment are reported. A 12-channel Fabry-Perot interferometer was constructed and profiles of various helium and impurity lines were measured as functions of time and position in the discharge tube. The standard deviation of the results was computed by a statistical analysis using a Monte-Carlo simulation program. This allowed the separation of real plasma variations from the fluctuations of the measurements. The main limitations of the accuracy of the results were due to lack of light intensity and parasitic broadening mechanisms. Nevertheless, reasonable values of the temperatures of ionised nitrogen, oxygen and helium were obtained for three different filling pressures. Author

N71-18631*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL EVIDENCE IN SUPPORT OF JOULE HEATING ASSOCIATED WITH GEOMAGNETIC ACTIVITY
Leonard L. De Vries 10 Feb. 1971 37 p refs
(NASA-TM-X-64569) Avail: NTIS CSCL 08N

High resolution accelerometer measurements in the altitude region 140 to 300 km from a satellite in a near-polar orbit during a period of extremely high geomagnetic activity indicate Joule heating to be the primary source of energy for atmospheric heating associated with geomagnetic activity. This conclusion is supported by the following observational evidence: (1) there is an atmospheric response in the auroral zone which is nearly simultaneous with the onset of geomagnetic activity; (2) the maximum heating occurs at geographic locations near the maximum current of the auroral electrojet; and (3) there is evidence of atmospheric waves originating near the auroral zone at altitudes where Joule heating would be expected to occur. An analysis of atmospheric response time to this heating shows time delays are apparently independent of altitude but are strongly dependent upon geomagnetic latitude. Author

N71-18650*# Bellcomm, Inc., Washington, D.C.
REPRESENTATION OF A GRAVITATIONAL POTENTIAL WITH FIXED MASS POINTS
W. I. McLaughlin 23 Dec. 1968 21 p refs
(Contract NASw-417)
(NASA-CR-116806; B68-12109) Avail: NTIS CSCL 03B

A least squares integral criterion is proposed for measuring goodness of fit between a given Newtonian potential and the potential of a mass point configuration. It is proved that if the mass point locations are held fixed there exists a unique set of mass values which best represents the given potential. A linear equation is derived which enables this set of mass values to be calculated. It is also shown that if a sufficient number of mass points are used, the fit can be made as close as is desired. Finally, a three mass point approximation to an oblate earth is developed as an illustration of the theory. Author

N71-18663# Heinrich-Hertz-Institut fuer Schwingungsforschung, Berlin (West Germany).
PERMANENT RECORDING OF WHISTLERS BY MEANS OF AN AUTOCORRELATION METHOD [DAUERREGISTRIERUNG DER WHISTLER-AKTIVITAET MIT HILFE EINES AUTOKORRELATIONS-VERFAHRENS]
G. Heydt and J. Frisius Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Oct. 1970 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-58) Avail: NTIS; ZLDI Munich: 7.80 DM

A new technique for the continuous analysis of whistler signals, identified by an electronic autocorrelation method using a fixed delay time, is described. The frequencies and field strength variations are indicated by analog output voltages. Data obtained over four weeks are discussed. Author (ESRO)

N71-18664# Air Force Cambridge Research Labs., Bedford, Mass.
AN IONOSPHERIC MODEL FOR THE ARTIC Environmental Research Papers
G. J. Gassmann 9 Oct. 1970 17 p refs
(AD-715893; AFCRL-70-0562) Avail: NTIS CSCL 4/1

A first order approximation model of the Arctic ionosphere is described, based on published observations and concepts. The model allows for modifications and additions whenever new information becomes available, and will eventually represent a true picture available in real time or even as forecast. The location of the phenomena is specified in corrected geomagnetic latitude and local time. Various input parameters are included whenever some of their influences are known, such as UT, seasons, sunspot number, magnetic variations. The Arctic ionospheric features are specified as quasi-instant deviations from routine predictions whereby the devitations represent probabilities of occurrence during periods that may range from 20 min to 3 hr. The following ionospheric features are more or less covered: auroral E (or night-E), auroral Es (or Esr), HF absorption, Arctic F. Necessary improvements to the model are indicated, including the inclusion of storm-time of individual substorms and the requirement that routine observations be maintained in the midnight sector of the auroral oval.
Author (GRA)

N71-18674# California Univ., Berkeley. Hydraulic Engineering Lab.
MAXIMUM WAVE HEIGHT PROBABILITIES FOR A RANDOM NUMBER OF RANDOM INTENSITY STORMS
Leon E. Borgman Nov. 1970 17 p refs
(Contract DACW72-69-C-0001)
(AD-715360; HEL-9-17) Avail: NTIS CSCL 8/3

A very general model is presented for the probability distribution function for wave heights in storms with time-varying intensities. Some of the possible choices for functions in the model are listed and discussed. Techniques for determining the equivalent rectangular storm corresponding to a given historically recorded storm are developed. The final model formula expresses the probabilities for a random number of random length storms each with random intensities.
Author (GRA)

N71-18675# Army Natick Labs., Mass. Earth Sciences Lab.
SURFACE MATERIALS AND TERRAIN FEATURES OF YUMA PROVING GROUND (LAGUNA, ARIZONA-CALIFORNIA, QUADRANGLE)
John A. Millett and Frank H. Barnett Oct. 1970 60 p *Its* Earth Sci. Lab. Ser. No. ES-59
(AD-715363; TR-71-14-ES) Avail: NTIS CSCL 8/6

Distribution and slope gradients of surficial materials in the Laguna (Ariz-Calif) 1:62,500-scale quadrangle were mapped in the field for engineering evaluation of vehicle testing suitability and for comparison of Yuma Proving Ground terrain with that of other world deserts. Occurrence and topographic expressions of seven alluvial and six bedrock mapping units are shown as an overprint on the topographic map. Cumulative frequency curves of slope and relief describe these factors of alluvial terrain quantitatively. Actual field measurements of 30,000 feet of traverse are included to permit interpretation for specific materiel evaluations.
Author (GRA)

N71-18688 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
A FERRITE CORE FLUXGATE MAGNETOMETER
F. Primdahl 1970 17 p refs Sponsored by Natl. Res. Council of Can. Its Publ. of the Earth Phys. Branch Vol. 40, No. 1
Copyright. Avail: Issuing Activity

A fluxgate magnetometer was designed and constructed to investigate the possibility of achieving the long-term stability required of the primary recording instruments at a standard magnetic observatory. An orthogonally-gated sensor is used, with a tubular ferrite core. The instrument was set up to measure total intensity, and compared with a proton precession magnetometer. The first test showed a drift of 2.5 gammas in 15 days. A second stability test gave an initial drift of 9 gammas over the first 20 days followed by random fluctuations of + or − 3.5 gammas over the next 60 days.
Author

N71-18727# California Univ., La Jolla. Scripps Inst. of Oceanography.
LABORATORY MEASUREMENT OF WAVE DIRECTION WITH A LINEAR ARRAY Final Report
J. N. Suhayda and A. Hecht Sep. 1970 24 p refs
(Contracts DA-49-055-CIVENG-66-1; DACW72-69-C-0030)
(AD-715725; SIO-REF-70-34) Avail: NTIS CSCL 8/3

A linear array of wave sensors was used in a laboratory wave basin to measure the direction of waves approaching from one and two directions. The basin is 18 meters x 15 meters x 1 meter. Two plunger type wave generators were used; one was on the 18-meter wall, the other on the 15-meter wall, so that the wave trains were normal to each other. The linear array was placed so that waves would approach at angles of 50 degrees from one generator and 40 degrees from the other. Three 1-millimeter minidigital staffs were used to measure waves. The staffs were connected by cable to a computer. Results are presented graphically and in tables. It appears that when used with full knowledge of its limitations, the linear array supplies the simplicity and accuracy needed for many nearshore wave array applications.
Author (GRA)

N71-18731# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
[ARCTIC ICE DYNAMICS JOINT EXPERIMENT (ADJEX) ACTIVITIES] Technical Report, 1 Oct. 1969 – 30 Sep. 1970
Norbert Untersteiner, Phil Church, Roger Evans, Charles Raymond, and Gary Maykut 1 Dec. 1970 70 p refs
(Contract N00014-67-A-0103-0007)
(AD-715450; AR-2) Avail: NTIS CSCL 8/12

In the report the research topics include: heat and mass budget of arctic sea ice, sea ice drift, micrometeorology, radiation, atmospheric chemistry and arctic oceanography.
Author (GRA)

N71-18756# National Oceanic and Atmospheric Administration, Rockville, Md.
RESEARCH IN GEOACOUSTICS AND SEISMOLOGY Final Report, 1 Jul. 1969 – 31 Aug. 1970
Harry Matheson Sep. 1970 6 p
(ARPA Order 846-10)
(AD-715886; AFOSR-70-2564TR) Avail: NTIS CSCL 8/11

The Geoacoustics Group of the Environmental Research Laboratories sponsors and monitors a geoacoustics network in the United States, South America, and Israel. Data from these stations is used to carry out a systematic search of all received analog magnetic tape records. Proper interpretation of the results of this search will lead to a better understanding of the vagaries of atmospheric propagation and of naturally occurring sources of infrasound.
Author (GRA)

N71-18757# Columbia Univ., Palisades, N.Y.
ARCTIC MARINE GEOPHYSICS AND OCEANOGRAPHY Semiannual Technical Summary Report, 1 Apr. – 30 Sep. 1970
Kenneth Hunkins 30 Sep. 1970 11 p refs
(Contract N00014-67-A-0108-0016)
(AD-715805) Avail: NTIS CSCL 8/10

Contents: (Navigation, bathymetry, gravity, magnetics, seismic profiler, sound scattering layers, bottom photography and nephelometry); Ocean currents; and Hydroacoustics.
GRA

N71-18804# Oregon State Univ., Corvallis. Dept. of Oceanography.
A COMPILATION OF OBSERVATIONS FROM MOORED CURRENT METERS, THERMOGRAPHS, AND WIND INSTRUMENT. VOLUME 4: PERU CONTINENTAL SHELF, MARCH–APRIL 1969
Dave B. Enfield, Robert L. Smith, June G. Pattullo, R. Dale Pillsbury, and Tom Hopkins Sep. 1970 48 p refs
(Contract N00014-67-A-0369-0007; Grant NSF GA-1435)
(AD-715784; DATA-44-Vol-4) Avail: NTIS CSCL 8/10

A summary of moored instruments over the continental shelf of Peru is presented. Measurements of variables were made in an upwelling zone between Pisco and San Juan, from 28 March to 9 April, 1969. Time series of temperature and horizontal current and wind velocities were obtained at several depths and locations by an array of moored, recording instruments. Supplementary hydrographic and drogue measurements were also made.
Author (GRA)

N71-18808# Naval Intelligence Command, Alexandria, Va. Translation Div.
SHOCK WAVES DURING THE MOVEMENT OF LARGE METEORITES IN THE ATMOSPHERE
M. A. Tsikulin 14 Dec. 1970 91 p refs Transl. into ENGLISH from the Russian
(AD-715537; NIC-TRANS-3148) Avail: NTIS CSCL 4/1

The book describes the formation and propagation of shock waves which arise during the entry of large meteorites into the Earths atmosphere. Results are presented of the experimental modelling and theoretical investigation of shock wave propagation in the atmosphere and their interaction with the Earths surface. The obtained data are applied to the study of explosive phenomena related to the fall of the Tunguska meteorite.
Author (GRA)

N71-18834# Naval Postgraduate School, Monterey, Calif.
SYSTEM TO DETECT AND REDUCE WIDE-ANGLE SEISMIC REFRACTIONS AT SEA
Stuart Kaufmann Edelson, Jr. (M.S. Thesis) Sep. 1970 88 p refs
(AD-715565) Avail: NTIS CSCL 8/10

A simple system was designed to collect wide-angle reflection records in order to investigate the interval sound speeds of the sediment layers in the ocean. The system consisted of a frequency modulated receiver, a cut-to-channel Yagi antenna, and a sonobuoy, used in conjunction with a precision sonic profile recorder and a triggered sound source. A computer routine for reducing the data was obtained and modified for compatibility with the system and use on the IBM 360/67 computer. The system was designed to be both inexpensive and simple to use without any loss of accuracy.
Author (GRA)

N71-18835# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
ATMOSPHERIC SPECTROSCOPY Final Report, 19 Mar. 1969–30 Sep. 1970
Robert F. Calfee 30 Nov. 1970 37 p
(ARPA Order 1390)
(AD-715482) Avail: NTIS CSCL 4/1

The purpose of the research discussed was to provide data on the absorption properties of atmospheric gases (water vapor, carbon dioxide, nitrous oxide, ozone, methane and carbon monoxide) and their effects upon the transmission of electromagnetic radiation. The important spectral regions from 1/cm (10000 micro m) to 10,000/cm (1 mico m) have been covered for these molecules. These data have been put in a uniform format suitable for use in computers. From these data it is possible to compute the absorption of radiation over any path with any concentration of absorber. This makes it possible to predict the effectiveness of sensing, tracking and guidance devices. These data are also necessary for calculating the heat balance and radiative transfer of planetary atmospheres. A more detailed account of the work appears in the body of the report.
Author (GRA)

N71-18851# Army Cold Regions Research and Engineering Lab. Hanover, N.H.
BIBLIOGRAPHY ON COLD REGIONS SCIENCE AND TECHNOLOGY. VOLUME 24, PART 1
Jul. 1970 257 p refs
(AD-715769; CRREL-12-Vol-24-Pt-1) Avail: NTIS CSCL 14/2

The Bibliography on Cold Regions Science and Technology is a continuing publication of the Cold Regions Bibliography Section in the Science and Technology Division of the Library of Congress. It is sponsored by and prepared for the Cold Regions Research and Engineering Laboratory (formerly for the Snow, Ice and Permafrost Research Establishment) of the U.S. Army Corps of Engineers. With volume 20 the title was changed to Bibliography on Snow, Ice and Frozen Ground, with Abstracts, and with volume 23 the current title was adopted. The present volume contains material accessioned between July 1969 and June 1970. The volume consists of two parts, each separately bound. Pt. 1 contains the full citation of 3628 items, numbered 24-1 through 24-3617, 24-4002, 24-4003, 24-4005 through 24-4008 and 24-4010 through 24-4014.
Author (GRA)

N71-18862# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
BIBLIOGRAPHY ON COLD REGIONS SCIENCE AND TECHNOLOGY. VOLUME 24, PART 2: INDEX
Jul. 1970 163 p refs
(AD-715717; CRREL-12-Vol-24-Pt-2) Avail: NTIS CSCL 14/2

The publication is a bibliography of research sponsored by the Cold Regions Research and Engineering Laboratory with author and subject indexes included.
GRA

N71-18868# Aerojet-General Corp., El Monte, Calif. Microwave Div.
PASSIVE MICROWAVE MEASUREMENTS OF OCEANOGRAPHIC PHENOMENA, ICE, AND SEDIMENTS Technical Report, 16 Nov. 1968–15 Feb. 1970
A. T. Edgerton, D. T. Trexler, G. A. Poe, A. S. Stogryn, and S. Akamoto Nov. 1970 116 p refs
(Contract Nonr-467(00))
(AD-715645; AGC-9016-R-7) Avail: NTIS CSCL 8/3

Airborne measurements were conducted off the Northern California coast to investigate microwave emission as a function of wave conditions. The measurements were performed at observational wavelengths of 21 and 0.81 cm. A series of rosette patterns centered near the San Francisco Light Ship were flown to acquire data parallel and perpendicular to the swell line. Sea surface and meteorological conditions were monitored by the light ship. The data have been analyzed in terms of changes in the average brightness temperature due to variations in the surface roughness and direction of propagation of the swell line relative to the aircraft flight path. Power spectral density analyses have been performed to determine if periodic variations in the microwave emission can be related to the period of the predominant wave structure. Measurements were taken at various altitudes and of a variety of sea states.
Author (GRA)

N71-18924# Oregon State Univ., Corvallis. Dept. of Oceanography.

A COMPILATION OF OBSERVATIONS FROM MOORED CURRENT METERS AND THERMOGRAPHS. VOLUME 3: OREGON CONTINENTIAL SHELF, MAY–JUNE 1967 AND APRIL–SEPTEMBER 1968

R. Dale Pillsbury, Robert L. Smith, and June G. Pattullo Jun. 1970 108 p refs

(Contracts N00014-67-A-0369-0007; Nonr-1286(10); Grants NSF GA-1435; NSF GA-295)

(AD-715650; Rept-40-Vol-3; Rept-70-3-Vol-3) Avail: NTIS CSCL 8/10

Time series of currents and temperatures taken by fixed arrays of self-recording instruments moored on the Oregon continental shelf are presented in graphical form. The data represent the periods from 6 May - 14 June 1967 and 1 April - 30 June 1968. Also included in this report are the observed and geostrophic winds for the same period of time. Author (GRA)

N71-18965*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OBSERVATIONS OF ACTIVELY FORMING LAVA TUBES AND ASSOCIATED STRUCTURES, HAWAII

Ronald Greeley Mar. 1971 35 p refs Submitted for publication

(NASA-TM-X-62014) Avail: NTIS CSCL 08G

Active basalt flows in the upper east rift zone of Kilauea volcano, Hawaii were observed, and previous flow descriptions were considered for speculation on mechanisms of lava tube and channel development. Observations are discussed which show that channel crusts and tube roofs form in several ways: (1) accumulation and thickening of thin surface scums which are fused together and attached to stationary channel sides; (2) accumulation and fusing of flexible, mobile crustal plates; (3) formation of stable, well-defined crusts along both channel sides; crusts grow to the center of the channel and merge; (4) agglutination of spattered lava in turbulent flows to form lateral levees; levees may arch over the channel and fuse; and (5) accretion of lava toe and lobe crusts at the flow front, extending an existing lava tube at about the same rate as the advance of the flow. Author

N71-18966*# Colorado Univ., Boulder. Dept. of Astro-Geophysics and Lab. for Atmospheric and Space Physics.

ROCKET INVESTIGATION OF THE Mg(I) AND Mg(II) DAYGLOW

James G. Anderson and Charles A. Barth Jan. 1971 41 p refs (Grant NGL-06-003-064)

(NASA-CR-116853) Avail: NTIS CSCL 04A

The 2800 A dayglow of ionized magnesium in a sporadic E layer was measured by a rocket-borne ultraviolet spectrometer. Because the 2852 A line of neutral magnesium was less than 10 Rayleighs while the ionized magnesium emission was measured to be 360 Rayleighs, the ratio of Mg(+) to Mg was determined to be greater than 22. A model of the ion chemistry in the sporadic E layer shows that neutral magnesium is ionized predominately by the charge transfer reaction with NO(+). In this model, Mg(+) is converted back into Mg by radiative recombination. Author

N71-18968*# Translation Consultants, Ltd., Arlington, Va.

CONTRIBUTION TO THE CONTRAST BETWEEN THE RESULTS OF LABORATORY AND IN SITU DETERMINATION OF PHYSICAL PARAMETERS ON THE BASIS OF SEISMIC WAVE VELOCITIES IN ROCK SALT [BEITRAG ZUR GEGENUEBERSTELLUNG DER ERGEBNISSE VON LABOR- UND IN SITU BESTIMMUNGEN PHYSIKALISCHER KENNWERTE AN HAND SEISMISCHER WELLENGESCHWINDIGKEITEN IM STEINSALZ]

B. Gerber Washington NASA Mar. 1971 12 p refs Transl. into ENGLISH from Bergakademie (Freiberg), v. 21, no. 7, 1969 p 397–400

(Contract NASw-2038)

(NASA-TT-F-13500) Avail: NTIS CSCL 08G

The discrepancy between laboratory and in situ determinations of natural rock parameters is quantified. The practical example of comparative velocities of seismic waves in rock salt was provided, using both transverse and longitudinal velocities. Histograms portrayed the comparative values of velocities and their ratio. The in situ investigation is recommended strongly over further laboratory experiments. Author

N71-18969*# Translation Consultants, Ltd., Arlington, Va.

GRAVITY OF LIGHT IN THE GRAVITATION THEORIES OF NEWTON AND EINSTEIN [UEBER DIE SCHWERE DES LICHTES IN DER NEWTONSCHEN UND DER EINSTEINSCHEN GRAVITATIONSTHEORIE]

H.-J. Treder Washington NASA Feb. 1970 10 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), v. 25, no. 3, 1970 p 315–320

(Contract NASw-2038)

(NASA-TT-F-13501) Avail: NTIS CSCL 08N

The differing positions of the gravitation theories of Newton and Einstein with respect to the velocity of light in a gravitational field are discussed. The velocity of light is greater, according to Newton's theory, and smaller, according to Einstein's general relativity theory, in a gravitational field than in field-free space. Shapiro's direct measurements by radar, confirming the decrease in the velocity of light in a gravitational field, represent the experimentum crucis for the gravitational theory of Einstein against that of Newton. The opposite predictions of these two theories about the velocity of light in a gravitational field are shown to result from the fundamental dissimilarity in the gravitation dynamics of light particles underlying the Newtonian and Einsteinian theories. Author

N71-18970# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.

METHOD FOR CONTROLLING INSTABILITY OF LIQUID SATURATION COMPUTATIONS

C. Kenneth Eilerts and Eudora F. Sumner Washington Mar. 1971 19 p refs

(BM-RI-7487) Avail: Issuing Activity

A method is described for controlling instability in finite-difference computations of liquid saturation near the borehole of a recovery well. Differences of pressure- and saturation-dependent variables are indexed offcenter, upstream and downstream alternately, to provide a stabilizing average. It is found that size of the time step can be increased by a factor of 4 without loss of numerical stability. Finite differences of the variables occur in a variety of relative numerical sizes and combinations. Those relationships of the differences that contribute to instability may be identified by the computing program in which they occur and modified to assist convergence of the computations and execution of the partial differential equations of liquid and gas flow. Author

N71-18972 Syracuse Univ., N.Y.

THE SELF-SCATTERING OF A GRAVITATIONAL WAVE

Manfred Leiser (Ph.D. Thesis) 1969 98 p

Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-1963

A solution to the linearized gravitational field equations is derived representing a gravitational wave imploding to the origin from the infinite past, and exploding again to the infinite future. The second order correction to this solution is derived, and the initial data is set so that the second order incoming news function is zero. The requirement that the second order solution should be free of intrinsic singularities then uniquely determines the outgoing news function. It is found that the second order outgoing news

is nonzero in that region of space time where the first order outgoing news is also nonzero, but zero elsewhere. This is interpreted to mean that the wave scatters itself. Correct to second order, the total masses in the incoming and outgoing fields are equal. When third order corrections are taken into account it is shown that in general the energy in the outgoing field may be less or greater than that in the incoming field. It is concluded that the incoming wave deposits a nonsingular positive or negative mass distribution near the origin. Dissert. Abstr.

N71-18974*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

THE EARTHS GRAVITY FIELD TO 16TH DEGREE AND STATION COORDINATES FROM SATELLITE AND TERRESTRIAL DATA

E. M. Gaposchkin and K. Lambeck (Observatoire de Paris, Meudon, France) Feb. 1971 63 p refs

(Grant NGR-09-015-002)

(NASA-CR-116850) Avail: NTIS CSCL 08N

Geodetic parameters describing the earth's gravity field and the positions of satellite-tracking stations in a geocentric reference frame were computed. These parameters were estimated by means of a combination of four different types of data: routine and simultaneous satellite observations, observations of deep-space probes, and measurements of terrestrial gravity. Author

N71-18977# Lamont Geological Observatory, Palisades, N.Y.

ARCTIC OCEAN GEOPHYSICAL STUDIES. THE ALPHA CORDILLERA AND MENDELEYEV RIDGE

John K. Hall Nov. 1970 143 p refs

(Contract N00014-67-A-0108-0016)

(AD-715656; TR-2) Avail: NTIS CSCL 8/10

The geophysical findings from Fletchers Ice Island (T-3) for the period mid-1962 to mid-1970 are presented. During this time the ice station traversed the Chukchi Rise, portions of the Alpha Cordillera and Mendeleyev Ridge, and the Chukchi, Mendeleyev, and Canada Plains. The findings, together with pertinent observations from older investigations, support the suggestion of earlier investigators that the Alpha Cordillera is an inactive center of seafloor spreading. Several fractures were observed to cut the Mendeleyev Ridge and Alpha Cordillera, and many other closely spaced fractures are suggested by topographic, magnetic, and gravity trends. These fractures appear to parallel the 142 degrees West meridian. Seismic reflection profiles show a buried topography similar to that of the Mid-Atlantic Ridge. Offsets in the apparent axial rift suggest that the fractures are the traces of transform faults. The angular relationship between the Mendeleyev Ridge and the Alpha Cordillera appears to result from a southerly displacement of the cordillera crest along numerous en echelon transform faults. Magnetic anomalies are consistent with the seafloor spreading hypothesis. Author (GRA)

N71-18978# Avco-Everett Research Lab., Everett, Mass.

FEASIBILITY STUDY OF REMOTE MONITORING OF GAS POLLUTANT EMISSIONS BY RAMAN SPECTROSCOPY

Donald A. Leonard Dec. 1970 57 p refs

(Contract CPA-22-68-62)

(RR-362) Avail: Issuing Activity

The feasibility was determined for using laser Raman scattering to remotely monitor the emission of NO and SO2 from large stationary sources such as electric power plants. No previous experimental measurement of the Raman scattering cross sections was known to have been made for either NO or SO2, these cross sections were measured in the laboratory using a 3371 A pulsed nitrogen laser as the Raman exciting source. Using N2 as a normalizing standard, the results are best fit by a NO to N2 Raman cross section ratio of 0.5 + or − 0.1 and a SO2 to N2 Raman cross section ratio of 2.4 + or − 0.3. A field study was carried out with a laser Raman spectrometer utilizing a 3371 A pulsed nitrogen laser installed in a van at the site of a large electric power plant. Raman spectra of N2, O2, H2O and CO2 were obtained from the power plant stack plume at a slant range of 625 feet without interference, and detailed field procedures were developed which permit quantitative profiles of the concentration of these molecules in the plume to be routinely obtained. However, NO and SO2 were not observed in the field study, due primarily to the insufficient stray light rejection ratio of the monochrometer. Author

N71-18981# National Weather Service, Silver Spring, Md. Techniques Development Lab.

WAVE CLIMATOLOGY FOR THE GREAT LAKES

N. A. Pore, J. M. McClelland, C. S. Barrientos, and W. E. Kennedy Feb. 1971 65 p refs

(NOAA-TM-NWS-TDL-40) Avail: Issuing Activity

The ten year observations are summarized for each of the lakes according to month. An overall summary for all months together is given for each lake. The cumulative frequencies of wave height for each lake are shown on a logarithmic scale. A problem in the coding of very low period waves prior to 1968 is briefly discussed. Author

N71-18991*# Translation Consultants, Ltd., Arlington, Va.

INVESTIGATION OF THE EFFECT OF HIGH TEMPERATURES AND PRESSURES ON CHANGE IN VELOCITY IN IGNEOUS AND METAMORPHIC ROCKS [ISSLEDOVANIYA VOZDEYSTVIYA VYSOKIKH TEMPERATUR I DAVLENIY NA IZMENENIYE SKOROSTI V IZVERZHENNYKH I METAMORFICHESKIKH GORNYKH PORODAKH]

T. S. Lebedev et al Washington NASA Mar. 1971 28 p refs Transl. into ENGLISH from Geofiz. Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz. (Kiev), no. 31, 1969 p 75–92

(Contract NASw-2038)

(NASA-TT-F-13515) Avail: NTIS CSCL 08G

Improvements in the methodology and equipment used to conduct an experimental study of the effect of temperature and pressure on the change that takes place in the propagation of elastic longitudinal waves in specimens of igneous and metamorphic rocks from the center of the Ukrainian shield are discussed and described. Previously known efforts in the field are presented. Author

N71-18995*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.

ROCKET MEASUREMENT OF THE SECONDARY ELECTRON SPECTRUM IN AN AURORA

P. D. Feldman, J. P. Doering, and J. H. Moore Oct. 1970 21 p refs Submitted for publication

(Grant NGR-21-001-001)

(NASA-CR-116858; TR-26) Avail: NTIS CSCL 04A

The differential flux of secondary electrons with energy greater than 6 eV was measured in a steady IBC II(+) aurora with an electron spectrometer aboard an Aerobee rocket. Except for the absence of structure in the energy range 10–20 eV, the observed spectrum is in excellent agreement with a recent theoretical prediction. About one-half of the observed N2(+) emission at 3914 A can be accounted for by secondary electron excitation. Author

N71-18996*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.

A REPORT ON SOME RESULTS FROM THE NASA 1968 AIRBORNE AURORAL EXPEDITION

K. A. Dick and W. G. Fastie Aug. 1970 44 p refs

(Grant NGR-21-001-001)

(NASA-CR-116855; TR-24) Avail: NTIS CSCL 04A

The spectrometer scanned a region n lambda (12,400–14,000 A), with the capability of isolating second, third, and fourth orders by means of Corning color glass filters. The photometer sampled each feature two out of every ten seconds; the spectrometer scanned every 15 seconds. The results are reviewed for some 124 hours of flying of approximately a quarter million photometer readings and thirty thousand spectral scans (each with as many as 400 resolution intervals). Author

N71-18997*# Pittsburgh Univ., Pa. Dept. of Physics.
A MASS SPECTROMETER OBSERVATION OF NO IN AN AURORAL ARC
E. C. Zipe, W. L. Borst, and T. M. Donahue 27 Jul. 1970 34 p refs
(Grant NGR-39-011-113)
(NASA-CR-116877; SRCC-133) Avail: NTIS CSCL 04A

The neutral and ion data obtained by mass spectrometer are discussed. The mass spectrometer observed remarkably large concentrations of NO and NO(+) within the auroral form. The molecular ions O2(+) and N2(+) were conspicuously absent and comparatively large densities of O(+) ions were detected. In the altitude range 110 km to 130 km the neutral NO concentration exceeded the ambient O2 concentration. Author

N71-19024 Rensselaer Polytechnic Inst., Troy, N.Y.
AN INVESTIGATION OF SOME ASPECTS OF CHEMILUMINESCENT AND PHOTOCHEMICAL PROCESSES OF VARIOUS ATMOSPHERIC CONSTITUENTS
Michael Angelo Riozzi (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-2642

A definite tendency toward second order was observed for the light emission in the N-atom recombination reaction. The afterglow was examined spectroscopically at high and low pressures and found to be constant in maintaining a discrete band structure. Variation of the intensity with pressure in the 5 to 20 micron pressure region showed the reaction order for the recombination of nitrogen atoms to be definitely less than 3. The red doublet from the emission of O 1D to O 3P2,1 transition was not seen; the attempts to generate a visible emission included the use of oxygen photodissociation by the 1633 A line of bromine. Photolysis of SO2 with the 2062 A iodine line resulted in the production of O-atoms which reacted with acetylene and ethylene rapidly, with methane slowly, and not at all with hydrogen or carbon dioxide. A decrease in the absorption coefficient of pure SO2 for 2062 A for increasing pressure was found and explained in terms of a layer thickness. Dissert. Abstr.

N71-19025# Coast and Geodetic Survey, Rockville, Md.
UNITED STATES EARTHQUAKES, 1968
Jerry L. Coffman and William K. Cloud [1969] 115 p refs
Avail: SOD $1.25

Shocks occurring in the United States, the Panama Canal Zone, Puerto Rico, and the Virgin Islands are summarized. Maps showing epicenters, data on well water level fluctuations, and strong motion seismograms are presented. Principal earthquakes of the world during 1968 are also listed. N.E.N.

N71-19083*# Lunar Science Inst., Houston, Tex.
A CLASSIFICATION OF METEORITE IMPACT CRATERS
Friedrich Heorz and Luciano B. Ronca [1970] 18 p refs
Submitted for publication *Its* Lunar Sci. Inst. Contrib. No. 15
(Contract NSR-09-051-001)
(NASA-CR-116890) Avail: NTIS CSCL 08G

A systematic classfication of meteorite impact craters based on the log of crater diameter in km is proposed. The following classes are differentiated: 2 microns to 200 microns in diameter, nanocraters; 200 microns to 2 cm, microcraters; 2 cm to 2 m, craterlets; 2 m to 200 m, small craters; 200 m to 20 km, intermediate craters; and 20 km to 2000 km, large craters. Such a classification is believed to facilitate the discussion of lunar craters and impact structures on planetary surfaces. Author

N71-19084*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
ROCKETBORNE SPECTROSCOPIC MEASUREMENTS IN THE ULTRAVIOLET AURORA: THE NITROGEN VEGARD-KAPLAN BANDS
William E. Sharp [1970] 47 p refs
(Grant NGL-06-003-064)
(NASA-CR-116888) Avail: NTIS CSCL 04A

Altitude profiles of the band emissions from the Vegard–Kaplan and second positive systems of N2 were obtained. Consideration of all the excitation processes of the N2 triplet states shows that the production of the A (3 Sigma u +) state is proportional to the production of the C (3 Pi u) state. The volume emission rate profile of the Vegard–Kaplan system deduced from the column emission rate indicated that the system was quenched. Comparison of the volume emission rate of the second positive and Vegard–Kaplan systems gives quenching rates for the v' = 0 and 1 levels of the A (3 Sigma u +) state which vary smoothly from 100/sec at 100 km to 0.3/sec at 220 km. At high altitudes, the most likely quenching agent is atomic oxygen with molecular oxygen becoming important below 120 km. With the use of a model atmosphere, the coefficients for the quenching of the v' = 0 and 1 levels of the A (3 Sigma u +) state of N2 by atomic oxygen are calculated to be 9 × 10 to the minus 11th power/sec and 1.1 × 10 to the minus 10th power/sec, respectively. The ratio of quenching coefficients for atomic oxygen and molecular oxygen is 4.2. The rotational temperature of the A (3 Sigma u +) state increases with altitude Author

N71-19085# National Center for Atmospheric Research, Boulder, Colo.
DIGITIZED GLOBAL MONTHLY MEAN OCEAN SURFACE TEMPERATURES
W. M. Washington and L. G. Thiel Dec. 1970 33 p refs
Supported by NSF
(NCAR-TN-54) Avail: Issuing Activity

Monthly means of the global sea surface temperature were produced in the form of composite charts for use with the NCAR general circulation model. These monthly charts are for the northern and southern hemispheres and for the tropics. Author

N71-19086# National Environmental Satellite Center, Washington, D.C.
FIRST FIVE YEARS OF THE ENVIRONMENTAL SATELLITE PROGRAM: AN ASSESSMENT Report to the Administrator of the National Oceanic and Atmospheric Administration
Feb. 1971 35 p
Avail: Issuing Activity

Examples of the variety of direct, continuing benefits to environmental observation and prediction in the United States and overseas are reviewed. Weather forecast and warning services are emphasized, and maritime, hydrologic, space environment, and earth mapping services are discussed. A primary characteristic is considered to be the effectiveness of the satellite in providing information, routinely and dependably, especially over oceans and remote land areas. Other important factors are identified as the rapidity with which forecast offices receive weather photographs and charts, the overall view of the earth and atmospheric features, and the utilization of meteorological satellite data by other nations. N.E.N.

N71-19107# Israel Program for Scientific Translation, Ltd., Jerusalem.
OPTIMUM EQUIPMENT OF SEISMIC STATIONS WITH INSTRUMENTS FOR RECORDING STRONG EARTHQUAKES [OB OPTIMALNOM OBORUDOVANII SEISMICHESKIKH STANTSII PRIBORAMI DLYA ZAPISI SILNYKH ZEMLETRYASENII]
Z. I. Aranovich et al 1970 25 p refs Transl. into ENGLISH from the publ. Apparatura i Metodika Seismometricheskikh Nablyudenii (Seismografy, Ostsillografy, Analizatory)' Moscow, Izd-Vo., 1967 p 115–125 Sponsored by NOAA and NSF
(IPST-S854; TT-70-50121) Avail: NTIS CSCL 08K

Considering the characteristics of instruments currently in production and the location of seismic stations in relation to seismically active regions, five optimum sets of instruments were recommended; they ensure satisfactory registration of all strong shocks, and a long-term plan was worked out for equipping Soviet seismic stations. Initial data and criteria for selecting instruments are given. Author (GRA)

N71-19108*# California Univ., Berkeley. Space Sciences Lab.
PERMAFROST Technical Report, 8 Jul. 1968–31 Dec. 1970
Jose Seixas Lourenco and Stanley H. Ward Oct. 1970 61 p *Its* Space Sci. Lab. Ser. 11, Issue 16
(Contract NAS2-5078)
(NASA-CR-116879) Avail: NTIS CSCL 08M

Some definite criteria for the occurrence of permafrost are established. It is shown that slight changes in temperature will upset the thermal balance that controls the occurrence of permafrost, thus causing changes in its thickness and extent. Inhomogeneities, such as ice and brine inclusions and taliks, which can produce changes in electrical conductivity of an area, are discussed. It is inferred that, if permafrost does exist locally or ubiquitously in the lunar crust, it could very well exhibit the wide ranges of conductivity and dielectric constant as found on earth. Author

N71-19115*# Xavier Univ., Cincinnati, Ohio. Dept. of Physics.
OBSERVATIONS ON PULSATING AURORAS
R. E. Miller and W. M. Zeitz Jan. 1971 15 p refs Submitted for publication
(Grant NGR-36-014-006)
(NASA-CR-116892) Avail: NTIS CSCL 04A

Optical auroral pulsations in lambda 3914 N2(+) and lambda OI have been measured in the frequency range 0.01 to 1.0 Hertz by a double photometer system during the NASA Airborne Auroral Expedition. The spectral density calculations invariably show a pronounced peak in the 0.05 to 0.2 frequency range. The pulsating forms were confined to the region between 62 deg and 69 deg North latitude. No pulsations were detectable in the lambda 4861 H beta emission. Author

N71-19127# Weapons Research Establishment, Salisbury (Australia). Dept. of Supply.
UPPER ATMOSPHERE TEMPERATURES FROM GRENADE GLOW CLOUDS USING AN ECHELLE SPECTROGRAPH WITH IMAGE INTENSIFIER
R. G. Roper and C. H. Low Nov. 1969 63 p refs
(HSA-161) Avail: NTIS

The Echelle spectrograph was used to obtain temperature profiles from 150 to 250 km above Woomera by recording the aluminum monoxide band spectra of aluminized grenades. The grenades were released at morning and evening twilight on 31 May 1968 by Skylark rockets. The spectrograph, which has a resolution of 0.73 A, just resolves the rotational line structure of the resonance radiation from AlO molecules. The observations are compared with simulated spectral profiles. Author

N71-19128# Joint Publications Research Service, Washington, D.C.
GRAVITY MEASUREMENTS WITH GRAVIMETER ON A MOBILE PLATFORM
V. A. Kuzivanov et al 17 Feb. 1971 5 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 195, no. 6, 1970 p 1329–1331
(JPRS-52414) Avail: NTIS

A method of obtaining gravimetric surveys at sea is described, based on the determination of discrete readings of the sensing system gages when the effect of sign-variable inertial accelerations on the pendulum readings is close to zero. The method involves comparing readings of two identical highly damped pendulums, differing only in the degree of damping. The amplitudes of the pendulums differ, but the points of intersection of the readings are situated near the equilibrium point which the pendulums occupy under the effect of gravity alone. Two modifications of the technique using only one highly damped pendulum are described. N.E.N.

N71-19129# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIURNAL OXYGEN VARIATIONS AT 65–200 km ALTITUDES
M. K. Ivelskaia et al 8 May 1970 5 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 10, no. 6, 1970 p 1048–1052
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The continuity equations describing the altitude-time changes in concentration of atomic and molecular oxygen in the 65–200 km altitude range are solved. The results of the solution display a diurnal behavior with amplitude of approximately 1.5-fold at 200 km, which agrees satisfactorily with experimental results for this altitude. Author

N71-19130# Lockheed Missiles and Space Co., Palo Alto, Calif.
AERONOMIC CHARACTERISTICS OF THE D REGION AND ENERGETIC SPECTRA OF THE IONIZING RADIATION OF 30 OCTOBER 1969
G. Nestorov 4 May 1970 5 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 10, no. 6, 1970 p 1057–1061
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A quasi-exponential model of the vertical distribution of the electron concentration in the D region is utilized to determine some fundamental parameters of this domain. The energetic spectra of hard solar X-radiation in both the quiet periods and during the solar flares of 30 October 1969 were also obtained. Author

N71-19135*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
ROCKET MEASUREMENTS OF UPPER ATMOSPHERIC NITRIC OXIDE AND THEIR CONSEQUENCES TO THE LOWER IONOSPHERE
Luiz Gylvan Meira, Jr. Washington NASA Feb. 1971 144 p refs
(Grant NGL-06-003-064)
(NASA-CR-1690) Avail: NTIS CSCL 04A

The nitric oxide density profile in the upper atmosphere between 70 and 110 km was measured with scanning ultraviolet spectrometers aboard two Nike-Apache rockets. The observed nitric oxide density profile has a maximum of about 10 to the 8th power per cubic centimeter at 105 km, and a minimum of about 10 to the 7th power per cubic centimeter at 85 km. Photochemical equilibrium is prevalent at about 85 km while mixing dominates below that altitude. A model in which nitric oxide is formed from

N(2D) atoms can explain the observed features of the height profile, provided that the recombination of nitric oxide ions produces excited nitrogen atoms more efficiently than ground state atoms. The contribution made by nitric oxide ionization by solar Lyman-alpha to the total ions production is dominant in the middle D region (below 90 km) for the solar activity level at the time of the experiments. Dissociative recombination of nitric oxide ions is the main loss process in the region about 85 km. Below that height, a faster mechanism is required. Author

N71-19148*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.

SOME SPECTROMETRIC RESULTS FROM THE NASA 1968 AIRBORNE AURORAL EXPEDITION AND TENTATIVE IDENTIFICATION OF SEVERAL N2 c PRIME (1 SIGMA u +) YIELDS a (1 Pi g) BANDS IN AURORAS

K. A. Dick Aug. 1970 23 p refs Submitted for publication
(Grant NGR-21-001-001)
(NASA-CR-116856; TR-25) Avail: NTIS CSCL 04A

The spectrophotometer measurements taken included numerous weak auroral features. The permitted OI line at 4368 A was found to have an intensity ratio to the N2(+) 1NG (0,1) band at 4278 A of 1:60 under a variety of auroral conditions. The forbidden NI line at 3466 A was seen to vary in intensity relative to 4278. Its variation follows OI6300 A, and may be used as an indicator of precipitating electron energy changes. The continuum at 6700 A was found to have a value < 1/2 R/A in an area through which an arc had recently passed. Tentative identification of two bands of the N2 c prime (1 sigma u plus) yields a (1 Pi g) system was made from auroral spectrometer results. The (0,0) band at 2827 A was identified on a spectrum taken aboard an Aerobee sounding rocket flown from Fort Churchill in 1967. The (0,2) band at 3119 A was found on some averaged spectra during the 1968 Expedition. Estimates of the intensities of these very weak bands show each to be approximately .2% to .5% as intense as the N2 second positive system. Author

N71-19251*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

SECOND ANNUAL EARTH RESOURCES AIRCRAFT PROGRAM STATUS REVIEW. VOLUME 1: GEOLOGY AND GEOGRAPHY

1969 341 p refs Conf. held at Houston, Tex., 16–18 Sep. 1969 Original Contains Color Illustrations
(NASA-TM-X-66913) Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

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N71-19252*# Geological Survey, Washington, D.C.

GEOLOGIC APPLICATIONS PROGRAM: SUMMARY OF RECENT PROGRESS AND PLANS

William R. Hemphill *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 4 p refs Sponsored in part by NASA (See N71-19251 08-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

The progress during FY 1969 and 1970, of the program to evaluate the application of airborne and satellite-borne remote sensing systems to the discrimination and identification of geologic materials is summarized. It is concluded that satellite observation is suited to prospecting for offshore placers as some changes in coastal areas are sufficiently rapid to be observed on repetitive imagery. F.O.S.

N71-19253*# Geological Survey, Tampa, Fla.

APPLICATION OF COMPUTER PROCESSED MULTISPECTRAL DATA TO THE DISCRIMINATION OF LAND COLLAPSE (SINKHOLE) PRONE AREAS IN FLORIDA

A. E. Coker, R. Marshall, and N. S. Thomson *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 17 p refs Prepared in cooperation with Michigan Univ., Ann Arbor (See N71-19251 08-13)
(NASA Order R-146-09-020-011)
Avail: NTIS HC $6.00/MF $0.95 CSCL 08G

The study of land collapse phenomena using remote sensing techniques is discussed. Data obtained using the multispectral scanner systems consisted of various combinations of 18 spectral

bands ranging from 0.4 to 14.0 micron and several types of photography. Patterns that are hypothesized to be indicators of deeply buried relic sinks were chosen from photographic strips of the imagery representative of the 18 spectral bands. The data were processed for recognition of soil and vegetation characteristics through use of a multispectral computer processor. Author

N71-19254*# Geological Survey, Washington, D.C.
DIGITAL COMPUTER TERRAIN MAPPING FROM MULTISPECTRAL DATA, AND EVALUATION OF PROPOSED EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) DATA CHANNELS, YELLOWSTONE NATIONAL PARK: PRELIMINARY REPORT
Harry W. Smedes, Kenneth L. Pierce, Marc G. Tanguay, and Roger M. Hoffer *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 37 p refs (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

Digital computer processing of 12 wavelength bands of visible and reflective infrared scanner data has resulted in successful automatic computer mapping of eight terrain units in a Yellowstone National Park test site. Target areas in the scene were selected for training the computer. Statistical parameters of radiance such as mean, standard deviation, divergence, and covariance were computed for each category of material. These data were used in the computer program to determine which channels are most useful for recognition of all object categories studied, and to actually classify all the unknown data points into the known categories. The following terrain types have been mapped with greater than 80 percent accuracy in a 12-sqaure-mile area with 1,800 feet of relief: (1) bedrock exposures, (2) talus, (3) vegetated rock rubble, (4) glacial kame terrace, (5) glacial till, (6) forest, (7) bog, and water, and (8) shadows. In addition, shadows of clouds and cliffs are depicted. Author

N71-19255*# Geological Survey, Washington, D.C.
GEOLOGIC ANALYSIS OF THE X-BAND RADAR MOSAICS OF MASSACHUSETTS
Lincoln R. Page. *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 19 p refs (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

The X-band radar mosaic of Massachusetts, at a scale of 1:500,000, presents an overall view of the geologic and geographic features of the state. Lineament patterns allow recognition of major structural features that can be related by geologists familiar with local areas to faults, joints, folds, and stratigraphy of the bedrock and drumlins, fans, and channels of Pleistocene deposits. More refinement of the method is needed to obtain uniform quality of imagery, correctness of scale, and appropriate orientation of flight lines for maximum use in unknown terrain. Author

N71-19256*# Geological Survey, Denver, Colo.
THERMAL INFRARED INVESTIGATIONS, MILL CREEK AREA, OKLAHOMA
L. C. Rowan, T. W. Offield, Kenneth Watson, R. D. Watson, and P. J. Cannon *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 25 p refs (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

Thermal-infrared images obtained on flights over the Tishomingo anticline and South Flank near Mill Creek in the Arbuckle Mountains, Oklahoma, were used to study the possibility of identifying some common rock types from their diagnostic reflection and emission characteristics, and to evaluate the usefulness of infrared images in structural geologic investigations. The areas flown are underlain by folded and faulted Paleozoic dolomite, limestone, sandstone, shale, and Precambrian granite. Images were obtained at 6:00 a.m., 11:00 a.m., and 2:00 p.m. The predawn (6:00 a.m.) image was the most useful in distinguishing rock types. Of particular interest was a thermal contrast of dolomite (warm) and limestone (cool), sufficient to distinguish those rock types and to reveal facies changes between them. Theoretical considerations indicate that this thermal contrast arises from a combination of albedo and thermal-inertia characteristics distinctive of dolomites and limestones in many areas. Author

N71-19257*# Geological Survey, Corpus Christi, Tex.
REMOTE SENSING TECHNIQUES AS APPLIED TO COASTAL SEDIMENTATION, SOUTH TEXAS
Henry L. Berryhill, Jr. *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 15 p (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

A U. S. Geological Survey to study processes of sedimentation along the south Texas coast as a part of its Marine Geology Program is reported. The purposes of the study are to develop principles that can be used in studying and comparing coastal processes in general and to establish guidelines that can be used for the efficient management of not only the south Texas coast but other barrier coastlines of the United States. Remote-sensing techniques are applied as a complement to the regular field investigations in order to evaluate the usefulness of remote sensing in several aspects of the study of sedimentation processes: 1) to determine bottom topography in shallow water; 2) to show the morphology of sand bodies in the several environments of deposition: shallow marine, barrier island and lagoon; 3) to determine the movement pattern of sediments in suspension at a given time and under a specific climatic and sea state condition; and 4) to monitor the coastline on a sequential basis as a means of relating rates of sediment movement to current patterns, sea state and atmospheric conditions. Special emphasis is on measuring rates of erosional healing following major storms or hurricanes. Author

N71-19258*# Geological Survey, Denver, Colo.
REMOTE DETECTION OF GEOCHEMICAL SOIL ANOMALIES
F. C. Canney *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 8 p (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08M

The spectral reflectance from trees growing in soil over a mineral deposit was compared with reflectance from trees of the same species growing in a nearby unmineralized area. Although the measurements were made on a relatively small number of trees, some significant differences were obtained and the overall results are encouraging enough to warrant additional studies. Preliminary results suggest that measurement of spectral reflectance may become a new way of detecting geochemical soil anomalies by remote means in tree-covered areas. Author

N71-19259*# Geological Survey, Menlo Park, Calif.
GEOLOGIC UTILITY OF SMALL SCALE AIRPHOTOS
Malcolm M. Clark *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 39 p refs (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

The geologic value of small-scale airphotos is emphasized by describing the application of high-altitude oblique and 1:120,000 to 1:145,000 scale vertical airphotos to several geologic problems in California. The examples show the small-scale airphotos can be of use to geologists. High-altitude, high-oblique airphotos show vast areas in one view, including the salient geographic and topographic attributes and many geologic features of an area. Vertical airphotos instantenously record rapidly changing conditions over large areas, such as tidal flow and surface wind patterns. Author

N71-19260*# Kansas Univ., Lawrence. Remote Sensing Lab.
EFFECTIVE RADAR LOOK DIRECTIONS FOR GEOLOGIC INTERPRETATION
H. C. MacDonald *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 21 p refs (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

The availability of multiple flight coverage from eastern Panama and northwestern Colombia has provided sufficient data for a semiquantitative look direction analysis in which the detection of certain geologic features under a variety of terrain conditions was examined. The geologic features selected are faults, joint systems, and dip slopes. Specific examples from those areas of the United States with multiple pass coverage are compared with the data obtained from the Panama imagery, and it is apparent that look direction does influence the detectability of certain geologic features. Depending on the relative topographic relief, effective incidence angle, and look direction, geologic features can be advantageously enhanced or can be completely suppressed. Geological reconnaissance in poorly mapped areas necessitates imaging from four orthogonal look directions to provide maximum terrain information. Where the terrain configuration or structural grain has already been determined, trade-offs between depression angle, range position, and look direction provide near optimum data retrieval with only two imaging passes. Author

N71-19261*# Geological Survey, Washington, D.C.
CARTOGRAPHY
Alden P. Colvocoresses *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 8 p (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08B

A review is given of the earth resources cartographic applications program as currently being implemented within the Topographic Division of the U.S. Geological Survey. The subject areas considered include: (1) goals of the program, (2) development of in-house capabilities, (3) relationship to NASA (MSC) aircraft program, and (4) current work on space imagery. Author

N71-19262*# Geological Survey, Washington, D.C.
SUMMARY OF OBJECTIVES AND PROGRESS IN THE GEOGRAPHIC APPLICATIONS PROGRAM
Arch C. Gerlach *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 12 p (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08E

Satellite remote sensing and data acquisition methods are described that proved most effective in applied geographical research. General accomplishments include soil and vegetation mapping, land use research for urban planning, ground water and fire detection, and plant disease identification. G.G.

N71-19263*# Georgia Univ., Athens.
REMOTE SENSING ANALYSIS OF GRASSLAND FIRE PHENOMENA: THE FLORIDA TEST SITES, 1968 - 1969
Merle C. Prunty *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 12 p (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

Data for the analysis of the occurrence, areally and temporally, of grassland or ground fires in tropical savannas are presented. The maintenance of the savanna vegetation type is believed to be primarily a function of ground fires. Recurrent ground fires are characteristic of savannas everywhere and apparently have been so for thousands of years. Although the role of fires in maintaining the ecology of savannas is known from numerous studies of small savanna areas, there is little uniformity, hence areal or temporal comparability among these studies. Remote sensing of ground fire phenomena from satellite platforms can provide observations that are standardized as to observational procedures, quality and time, and are both areally comprehensive and inclusive. Particularly, such observations can encompass large areas in a uniform manner. Author

N71-19264*# Kansas Univ., Lawrence. Dept. of Geography.
THEMATIC LAND USE MAPPING: SOME POTENTIALS AND PROBLEMS
David S. Simonett *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 43 p refs (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08B

Project work is discussed in three broad groups. The first group involves studies using Gemini and Apollo photography for boundary and road detection. This is followed by three studies dealing with the feasibility of making existing thematic maps from spacecraft data, comments on the resolution needs for thematic maps in different environments, and a comparison of time available for radar and photographic imagery obtained over the United States. Statements are also given on the results to date of the analyses of NASA aircraft data obtained over the Garden City and Lawrence sites. Author

N71-19265*# California Univ., Riverside. Dept. of Geography.
IMPERIAL VALLEY LAND USE STUDIES: A CONTINUUM FROM MISSION 73 TO APOLLO 9
Claude W. Johnson *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 10 p (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08G

Data obtained from Apollo 9 helped produce some final stages in the long term program of geographic land use via remote sensing in the Imperial Valley. The combination of aircraft, spacecraft, laboratory, and field investigations has made the Imperial Valley an exceptionally productive test site in the acquisition and application of geographic data. Emphasis is on use of color infrared photography and its application to land use studies. However, experiments with multiband photography, side-looking radar imagery, passive microwave imagery, scatterometer data, and thermal infrared imagery were conducted and partially evaluated. A significant step was the application of Apollo 9 imagery to computerized programs (on land use) that developed from data acquired from Mission 73. Author

N71-19268*# Geological Survey, Washington, D.C.
GEOGRAPHY PROGRAM REVIEW AND INTEGRATION
Robert H. Alexander *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 23 p (See N71-19251 08-13)
Avail: NTIS HC$6.00/MF$0.95 CSCL 08F

Recent research results in five areas are presented. (1) Land use changes and disaster effects were analyzed, and details are given on programs for Asheville Basin, Tennessee; Imperial Valley, California; and test sites in Florida. (2) Urban growth and environmental quality were monitored with respect to housing quality, air pollution, urban planning, urban change detection, and emergency preparedness. (3) Man-induced climatic changes were assessed with respect to surface heat and water balance. (4) Supplementary census information was obtained relative to the distribution of dwelling units and population in urban areas. (5) Small scale thematic maps were updated. Advances in other projects are also listed. N.E.N.

N71-19340 Israel Program for Scientific Translations, Ltd., Jerusalem.
SEDIMENTATION: ANNOTATED BIBLIOGRAPHY OF FOREIGN LITERATURE, 1967 - 1968

1969 400 p refs Transl. into ENGLISH from Selected Foreign Publications Sponsored by Dept. of Agriculture and NSF Prepared for Dept. of Agriculture and NSF *Its* Survey no. 5
(TT-69-55007) Copyright. Avail: NTIS HC$6.00

The bibliography contains references to the following: alluvial deposits, channels, coasts and deltas, erosion and erosion control, geomorphology, lakes and rivers, landslides, mudflows, rainfall, reservoirs, runoff, scour, sediment and sedimentation, soils, waves, weathering, and related topics. N.E.N.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-18160# Kernforschungszentrum, Karlsruhe (West Germany). Labor Fuer Elektronik Und Messtechnik.
SPECIFICATIONS OF THE CAMAC MHz COUNTER MODULE TYPE LEM-82/1.1
J. Ottes and K. Tradowsky Jun. 1970 15 p In GERMAN
(KFK-1184) Avail: AEC Depository Libraries

The CAMAC counter module may be computer-controlled or work with a digital controller. The module has a timer gate and a second gate which is switched on and off manually. The module is one unit wide. It has a 24-bit counting register and one overflow bit which is stored by the digital controller or computer and by the timer for preset count. The CAMAC counter timer system with digital controller or computer will replace the old ESONE counter timer system in the Karlsruhe Nuclear Research Center. Author (NSA)

N71-18236# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SPARK CHAMBER MAGNETIC SPECTROMETER FOR STUDYING THE RARE DECAYS AND INTERACTIONS OF PARTICLES
S. M. Korenchenko, A. G. Morozov, K. G. Nekrasov, and Yu. V. Rodnov 1970 16 p refs In RUSSIAN
(JINR-P13-5170) Avail: AEC Depository Libraries

A cylindrical spark chamber placed in the 9000 Oe magnetic field is described which has been designed for studying the rare decays and interactions of pions and muons. The chamber is 40 cm in diameter and 30 cm high. The total number of gaps is 18 and the size of each gap is 5 mm. The solid angle viewed by the chamber is about 6 steradian. The coordinates along the axis of the cylinder are measured with the help of a prismatic device which was not used for the spark chamber technique earlier. The chamber is filled with neon. To obtain the necessary purity of neon the continuous purification system was applied. The chamber operation is controlled by the TV system. The chamber is triggered by the hodoscope system consisting of 19 scintillation counters. Some of the scintillators are placed inside the chamber. Pulses from photomultipliers are displayed, in addition, on the 5-ray oscilloscope screen. Author (NSA)

N71-18280# General Electric Co., Philadelphia, Pa. Missile and Space Div.
APPLICATIONS OF AVALANCHE TYPE SEMICONDUCTOR RADIATION DETECTORS Final Report, Oct. 1968 – Nov. 1969
Philip A. Johnston Dec. 1969 50 p refs
(Contract AT(30-1)-4028)
(NYO-4028-TA-1) Avail: NTIS

The use of avalanche detectors in radioisotope applications where other detection systems may be compromised due to size, temperature, or fragility is described. The applications discussed include the development of a portable X-ray fluorescence analyzer for geochemical exploration of the Moon, a Mars soil analysis experiment, a silver ore analyzer, an archeological X-ray fluorescence analyzer, a beta particle pressure gauge, a cloud buoyancy gauge, an eggshell thickness gauge, and a tooth enamel gauge. Author (NSA)

N71-18283# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionale.
EFFICIENCY OF A TELESCOPE WITH A PLASTIC COUNTER AND LEAD CONVERTER FOR DISCLOSURE OF PHOTONS [EFFICIENZA DI UN TELESCOPIO DI CONTATORI PLASTICIE CONVERTITORI DI PIOMBO, PER LA RIVELAZIONE DI FONTONI]
G. Capon, M. A. Locci, G. P. Murtas, and G. Penso (Rome Univ.) 24 Mar. 1970 39 p refs In ITALIAN *Its* Nota Interna No. 471
(LNF-70/13) Avail: AEC Depository Libraries

The detection efficiency for photons with energies between 50 and 1500 MeV of a device constituted on a series of plastic scintillators interspersed with lead shields is studied. The experimental device is described in detail, and the Monte Carlo method used for the theoretical study of the efficiency is discussed. Results are compared and show that corrections in the theoretical calculations are necessary for the production of pairs and for low energy photons which can yield Compton electrons. These corrections give good results except in the case of very thick shields when the theoretical values can only be considered as indicative. NSA

N71-18287# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EVALUATION OF HANFORD BASIC THERMOLUMINESCENCE DOSIMETER
R. L. Kathren Jul. 1970 26 p
(Contract AT(45-1)-1830)
(BNWL-CC-2633) Avail: NTIS

The lithium-7 fluoride thermoluminescent dosimeter for personnel dosimetry is described and evaluated. The reader, structural and wear tests, and field tests are discussed. The range, linearity, sensitivity, precision, energy and angular dependence, extraneous radiation response, environmental effects, fading, annealing, and interrelationship of variables are evaluated. NSA

N71-18289# Lyon Univ. (France). Inst. de Physique Nucleaire.
STUDY OF ACTIVE FILTERS IN NUCLEAR SPECTROMETRY [ETUDE DE FILTRES ACTIFS EN SPECTROMETRIE NUCLEAIRE]
Yves Pagnotte (Ph.D. Thesis) Mar. 1970 95 p refs In FRENCH
(LYCEN-7008) Avail: AEC Depository Libraries

The problem of filtering signals coming from particle detectors was solved as a measurement problem, thus as a statistical estimation of the terms. It was shown how the theory of estimation led to a generalization and synthesis of the solutions to the optimal filtering problem, and to research into finding interesting filter networks. An attempt was made to describe from calculation and experiment the transient properties of these resistance capacitance filters. NSA

N71-18378# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
A DEVICE FOR POSITIONING THE ELECTRODES OF AN

ISOTOPE SEPARATOR COLLECTOR AND FOR CONTROLLING THE SHAPE AND INTENSITY OF THE ION BEAM [DISPOSITIF DE POSITIONNEMENT D'ELECTRODES DANS LE COLLECTEUR D'UN SEPARATEUR D'ISOTOPES ET DE CONTROLE DU FAISCEAU D'IONS EN FORME ET EN INTENSITE]

Romain Porru, Serge Choulet, and Christian Ristori Sep. 1970 9 p In FRENCH

(CEA-N-1323) Avail: AEC Depository Libraries

A remote control device for positioning the collector electrodes of an electromagnetic isotope separator is described. The electrodes are used for oscillographic observation, beam stabilization, and intensity measurement. These electrodes are moved in the collector by an endless screw and their position transmitted by a set of Seisyns to the separator control desk. Author (NSA)

N71-18407# Toulouse Univ. (France). Faculte des Sciences.

DEVELOPMENT OF AN AUTOMATIC PORTABLE AITKEN NUCLEUS COUNTER [REALISATION D'UN COMPUTER DE NOYAUX D'AITKEN AUTOMATIQUE ET PORTATIF]

Christian Cabrol (Ph.D. Thesis) 1970 4 p refs In FRENCH

(NP-18412) Avail: AEC Depository Libraries

After reviewing the general theory of the heterogeneous condensation, the realization of an automatic portable Aitken nucleus counter is presented. Theoretical and experimental calibrations are in good agreement. A large number of experiments were carried out under both free and confined atmospheres. Results obtained in a uranium mine show the importance of this parameter in radiation protection. NSA

N71-18408*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TERRAIN PHOTOGRAPHY FROM GEMINI SPACECRAFT Final Geologic Report

Paul D. Lowman, Jr. and Herbert A. Tiedemann Jan. 1971 79 p refs

(NASA-TM-X-65451; X-644-71-15) Avail: NTIS CSCL 14E

The objectives, methods, equipment, and main geologic results of the Synoptic Terrain Photography Experiment (S005) carried out by the astronauts during several Gemini missions in 1965 and 1966 are summarized. The objective of the S005 experiment was to obtain 70 mm color photographs of the earth's surface for geologic, geographic, or oceanographic study. The pictures were taken using hand-held cameras with 38 mm, 80 mm, and 250 mm focal length lenses; approximately 1100 photographs usable for geologic purposes were obtained, covering various areas between 32 N and 32 S. Geologic applications of the photographs are discussed. Author

N71-18409*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OCEANOGRAPHIC APPLICATIONS OF COLOR-ENHANCED SATELLITE IMAGERIES

K.-H. Szekielda and W. F. Mitchell Jan. 1971 17 p refs Submitted for publication

(NASA-TM-X-65454; X-651-71-53) Avail: NTIS CSCL 14E

Black and white infrared imageries obtained from satellites over the oceans were transformed into color presentations. Investigations in different regions (Persian Gulf, Arabian Coast, Somali Coast and the Northwest Coast of Australia) reveal that temperature gradients and temperature differences of two degrees Celsius can be displayed by the color process from the imageries. This data display can be used for a rapid analysis of information obtained with an APT station. Author

N71-18450# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

FLIGHT TEST RESULTS OF CACTUS HIGH SENSITIVITY ACCELEROMETER [RESULTATS DES ESSAIS EN VOL DE L'ACCELEROMETRE A HAUTE SENSIBILITE CACTUS]

Jacques Bouttes, Michel Delattre, and Remy Juillerat 1970 13 p refs In FRENCH; ENGLISH summary Presented at the Congr. Intern. d'Astronautique, Constance, West Ger., 4–10 Oct. 1970 Submitted for publication

(ONERA-TP-875) Avail: NTIS

The object of the Athalie experiment was to test on a sounding rocket the Cactus high sensitivity (threshold 10 to the −8th power m/sq sec) accelerometer. The results obtained during the 9th November, 1969, launching at the French Guiana Space Center show that Cactus worked satisfactorily. However it has not been possible, because of residual disturbances, probably due to the Vesta rocket itself, to qualify Cactus for the very low acceleration levels. On the other hand the atmospheric density profile, in the 120 to 150 km altitude zone, has been measured from the readings of the accelerometer, during the same flight, with a quite good accuracy; the results fit well with those provided by the OV1-15 and OV1-16 satellites for the higher altitudes, and with the standard atmosphere data for the lower ones. Author (ESRO)

N71-18465# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

APPARATUS AND METHOD FOR PROTECTING A PHOTOGRAPHIC DEVICE Patent

Richard L. Bailey and William C. Tibbitts, inventors (to NASA) Issued 14 Jul. 1970 (Filed 13 Dec. 1967) 6 p Cl. 95-11; Int. Cl. G03b17/02 Sponsored by NASA

(NASA-Case-NPO-10174; US-Patent-3,520,238; US-Patent-Appl-SN-690163) Avail: US Patent Office CSCL 14E

A camera to photograph a rocket engine nozzle in operation is positioned within a rugged enclosure cooled by water and pressurized by inert nitrogen to prevent particles from entering the enclosure. A viewing duct in the wall of the enclosure aligned with the camera lens is formed with a protective window at its inner end and a reduced diameter viewing port at its outer end. High pressure gas injected into the duct exhausts through the port as a high pressure jet which deflects the engine exhaust and prevents it from entering the duct and damaging the window or the camera. Official Gazette of the U.S. Patent Office

N71-18481# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THERMOPILE VACUUM GAGE TUBE SIMULATOR Patent

Paul R. Yeager, inventor (to NASA) Issued 6 Oct. 1970 (Filed 13 Sep. 1968) 4 p Cl. 73-4; Int. Cl. G01l27/00

(NASA-Case-XLA-02758; US-Patent-3,531,978; US-Patent-Appl-SN-759665) Avail: US Patent Office CSCL 14B

A device is described for simulating the actions of a thermopile vacuum gage tube at high and low pressures. A battery in series with a resistor simulates the voltage generated by the gage tube when operating at atmospheric pressure, and the battery in series with a second resistor simulates the voltage generated by the gage tube while exposed to a vacuum. Three other equal resistors are connected together at a common junction to simulate the resistances of the thermocouples in the gage tube. The device is used to check out thermopile vacuum gage circuits. Official Gazette of the U.S. Patent Office

N71-18482# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

IONIZATION VACUUM GAUGE WITH ALL BUT THE END OF THE ION COLLECTOR SHIELDED Patent

Forrest P. Clay, Jr. and Leonard T. Melfi, Jr., inventors (to NASA) Issued 9 Sep. 1969 (Filed 27 Apr. 1967) 5 p Cl. 313-7; Int. Cl. H01j7/16, 13/28, 17/24

(NASA-Case-XLA-07424; US-Patent-3,466,484; US-Patent-Appl-SN-635326) Avail: US Patent Office CSCL 14B

An ionization vacuum gage of the hot filament type having the ion collector buried or completely removed from the grid

structure of the gage is described. A shield is located between the grid structure and the ion collector which reduces the number of X-rays incident on the collector. The end of the grid opposite the ion collector is closed in one variable and in another variable an ion collector and shield are positioned at both ends of the grid structure. Official Gazette of the U.S. Patent Office

N71-18483# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
SORPTION VACUUM TRAP Patent
Alfred E. Barrington and Anthony J. Caruso, inventors (to NASA) Issued 30 Sep. 1969 (Filed 16 Oct. 1967) 6 p Cl. 55-208; Int. Cl. B01d19/00, 53/00
(NASA-Case-XER-09519; US-Patent-3,469,375; US-Patent-Appl-SN-676375) Avail: US Patent Office CSCL 14B

A sorption vacuum trap having a housing with a group of reentrant wall portions projecting into an internal gas-previous container filled with sorbent material is described. The reentrant wall portions accommodate external heaters which permit bake-out and outgassing of the sorbent material.
Official Gazette of the U.S. Patent Office

N71-18488# ARO, Inc., Arnold Air Force Station, Tenn.
HOLOCAMERA FOR EXAMINATION OF WATER DROPLETS IN A LARGE HIGH ALTITUDE TEST CELL Final Report
W. M. Farmer, K. S. Burgess, and J. D. Trolinger AEDC Dec. 1970 37 p refs
(Contract F40600-71-C-0002)
(AD-715916; AEDC-TR-70-181) Avail: NTIS CSCL 14/5

A series of experiments was performed in Engine Test Facility Propulsion Development Test Cell (J-1) to show that holography could be used to determine the water droplet information necessary to simulate the desired conditions in an operational environment. The experiments demonstrated the feasibility of applying holography to the visualization of small water droplet flow fields in a testing environment for droplet sizes down to approximately 15 microns.
Author (GRA)

N71-18583# Istituto Nazionale de Fisica Nucleare, Rome (Italy).
DESIGN OF THE OPTICS OF A SPARK CHAMBER EXPERIMENT
Ilkka Laakso 5 Jun. 1970 13 p *Its* Nota Interna No. 268
Avail: NTIS

A system of mirrors designed for the stereoscopic optical system for spark chambers used at CERN, is described. Four stereoscopic views of the main chambers were taken, to avoid ambiguity during track reconstruction. A FORTRAN computer program called RECON was written as an aid in the design of the system.
ESRO

N71-18606# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
STUDY OF A WALL FLUXMETER [ETUDE D'UN FLUXMETRE DE PAROI]
J. Bataille and P. Gougat Sep. 1970 28 p refs In FRENCH
(Rept-70-7) Avail: NTIS

Thin film fluxmeters have been developed for measurements in shock tubes. The utilization of such sensors for heat flux measurements on the surface of a flat plate is discussed. It is found that the fluxmeter is sensitive to both the local skin friction coefficient and heat flux variations. The calibration of the devices shows that the two dimensional theory is not suitable and three dimensional equations are developed. ESRO

N71-18607# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
MECHANICS AND OPTICS OF JUPITER TELESCOPE [ETUDE DE MECANIQUE ET D'OPTIQUE DU TELESCOPE JUPITER]
M. Detaille, B. Authier, J. Raynard, and P. Gravez 1970 53 p In FRENCH
Avail: NTIS

Design features of a Cassegrain telescope for the observation of Jupiter are discussed. The effects of tolerances for positioning the mirrors on the image are considered. Special attention is paid to thermal dilatation so that no noticeable aberrations are involved in the temperature range from −60 to +20 C. ESRO

N71-18608# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Triebwerksmesstechnik.
ON THE APPLICATION OF A ROTATING MIRROR CAMERA FOR INVESTIGATIONS OF MOVING LUMINOUS OBJECTS [BETRACHTUNGEN UEBER DIE VERWENDBARKEIT EINER DREHSPIEGELKAMERA, INSBESONDERE BEI UNTERSUCHUNGEN BEWEGTER SELBSTLEUCHTENDER OBJEKTE]
Klaus Peter Anders Sep. 1970 35 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-70-16) Avail: NTIS; ZLDI Munich: 10 DM

A rotating mirror camera and auxiliaries are described and values of space and time resolution are presented. The degree of picture blurring caused by the mirror rotation during the illumination and possible errors in the determination of the exposure time were calculated. Different photographic techniques for the investigation of a rotating electric arc are described and some experimental results of the arc movement given. Author (ESRO)

N71-18625* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH IMPACT PRESSURE REGULATOR Patent
Albert Topits, Jr., Elmer L. Floyd, and John E. Biles, Jr., inventors (to NASA) Issued 13 May 1969 (Filed 27 Nov. 1967) 5 p Cl. 137-505-12; Int. Cl. F16k31/165, 41/00; Int. Cl. F02b19/02
Sponsored by NASA
(NASA-Case-NPO-10175; US-Patent-3,443,583; US-Patent-Appl-SN-685787) Avail: US Patent Office CSCL 09A

An impact resistent pressure regulator having a minimum number of lightweight movable elements is described. The movable elements of the regulator are integrally connected to each other and to the regulator housing for reducing misalignment and damage to the regulator upon impact. The regulator contains two pressure chambers in fluid communication with each other. The entrance to each pressure chamber is valved and one wall of each pressure chamber comprises a thin metallic diaphragm. Each diaphragm is connected to the valved entrance and has a predetermined inherent biasing force so that when the pressure in each chamber overcomes the biasing force of the diaphragm the valved entrance to the respective chamber is closed. The diaphragms are the only biasing elements in the regulator.
Official Gazette of the U.S. Patent Office

N71-18652# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
THE ROLE OF IMAGE QUALITY IN PHOTOGRAMMETRIC POINTING ACCURACY
Sikke A. Hempenius Dec. 1969 285 p refs
(Contract DA-91-591-EUC-3721)
(AD-715441) Avail: NTIS CSCL 8/2

The acuity of the visual pointing operations - alignment of lines and pointing at circular targets - is discussed with respect to the visual stimuli involved and its limens. Computations and derivations are based on the optical convolution of the objects intensity distribution with the human eyes spread function, its 2-sigma-width being selected between 300 and 500 microrad. Relations with the visibility of points, lines, and straight and undulating edges and with simple geometrical forms are established

and presented in a diagram as a function of the angular subtense in object space. Accidental and systematic errors are given as function of image quality, magnification, and target contrast. The best attainable pointing accuracy under specific conditions can now be predicted; this allows the photogrammetric systems designer to evaluate the improvement of imaging quality of the optical-photographic system in terms of accuracy. Extension of the methods for application on subjective edge-location and on stereoscopic height measurements is indicated; various definitions of the subjective width of unsharp targets and boundaries are explored and will be researched on in the follow-up study on edge location and parallax clearance. Author (GRA)

N71-18699* American Optical Co., Pittsburgh, Pa.
TELESPECTROGRAPH Patent
George A. Ameer and Richard M. Walters, inventors (to NASA) Issued 29 Jul. 1969 (Filed 24 Aug. 1965) 7 p Cl. 250-83.3; Int. Cl. G01t1/16; Int. Cl. G01j3/42; Int. Cl. H01j39/00 Sponsored by NASA
(NASA-Case-XLA-03273; US-Patent-3,458,702; US-Patent-Appl-SN-487352) Avail: US Patent Office CSCL 17H

A telespectrograph for simultaneous analysis of three spectral ranges lying generally in the UV, visible, and IR, is described. It is especially suitable for analyzing the upper atmosphere by tracking bodies reentering the atmosphere at high velocities. Official Gazette of the U.S. Patent Office

N71-18759# National Research Council of Canada, Ottawa (Ontario).
THE STANDARD PHOTOELECTRIC PYROMETER OF THE ITALIAN INSTITUTE OF THERMOMETRY [IL PIROMENTO FOTOELETTRICO CAMPIONE DELL'ISTITUTO TERMOMETRICO ITALIANO]
G. Ruffino 1970 11 p refs Transl. into ENGLISH from Termotecnica (Milan), v. 21, no. 11, 1967 p 44–47
(NRC-TT-1431) Avail: NTIS

The main features of the pyrometer are the interchangeability of the interference filters, which permit operation at wavelengths of 0.650 and 1.0 microns, and redesign of a synchronous contact demodulator which operates at 420 Hz. Author

N71-18760# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE GEODIMETER NASM-2A: OPERATIONAL PERFORMANCE, ACCURACY AND ERROR EFFECTS IN FIELD MEASUREMENTS [DAS GEODIMETER NASM-2A: WIRKUNGSWEISE, GENAUIGKEIT UND FEHLERE INFLUESSE BEI FELDMESSUNGEN]
Hansdieter Grosse 1970 46 p refs In GERMAN; ENGLISH summary
Avail: NTIS

The use of the NASM-2A geodimeter for scale control in the West German part of the European First-Order Triangulation Net is discussed. Numerous sides of first and second-order triangulation were remeasured to acquire detailed experience in the field of electro-optical distance measurement. The measuring procedure has been modified and adapted to practical requirements. The established instrument constants and the frequency controls for the entire measuring period extending from 1959 to 1966 are the basis on which the distances are computed. Author

N71-18767# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
A PORTABLE SPECTROPHOTOMETER FOR GEOPHYSICAL APPLICATIONS
Ronald R. Roulet Dec. 1970 101 p refs
(Contract N00014-67-A-0103-0007)
(AD-715790; SR-9) Avail: NTIS CSCL 20/6

Specifications, design considerations, and construction of an advanced spectrophotometer are discussed. This spectrophotometer represents a significant improvement over existing light measuring instruments. It is designed to measure light intensities in the visible spectrum (0.4 - 1.1 microns) with a relative accuracy of 1%. Transmitted or scattered light can be measured as a function of wavelength and direction. The wavelength resolution is adjustable down to 100 A. A small remote pickup unit, consisting of a photodiode and a lens system, is connected to the instrument by optical fibers and allows measurements up to six feet from the instrumentation. Although the spectrophotometer can be used in any work where extreme wavelength resolution is not needed, it was primarily designed for experiments with ice and snow. Author (GRA)

N71-18928 California Univ., Los Angeles.
A GENERALIZED THEORY FOR FABRY-PEROT OPTICAL RESONATORS
Ting-Jau Timothy Fong (Ph.D. Thesis) 1969 225 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 70-2201

The diffraction of electromagnetic waves is considered for a Fabry-Perot resonator containing a finite medium, which can be either isotropic or uniaxially anisotropic. In either cases both the rectangular and circular reflectors are investigated. Formulas are derived for the cases that the resonators are formed by infinitely large reflectors containing a finite medium. In the cases that both the reflectors and the medium are finite, no explicit formulas can be derived, numerical method must therefore be used to solve the problem. The numerical solutions show that when the relative dielectric constant between the laser medium and the surrounding material is small, the resonator properties approach that of an empty resonator. When the difference between dielectric constants is large, the resonator properties approach that of a resonator formed by infinite reflectors. Dissert. Abstr.

N71-18950*# Denver Univ., Colo. Dept. of Physics.
BALLOON BORNE HUMIDITY AND AEROSOL SENSORS
D. G. Murcray and D. B. Barker 16 Feb. 1971 42 p refs
(Contract NAS8-30179)
(NASA-CR-61339) Avail: NTIS CSCL 14B

A state-of-the-art survey of humidity and aerosol sensors emphasized those techniques and instruments that could possibly be used with nonrecoverable rawinsonde balloon type packages to explore the first 20 km of the atmosphere. A literature search plus discussions with investigators active in this field provided background data for a study of promising techniques. Theoretical and experimental analyses established the feasibility of sensing atmospheric humidity through IR emission. Author

N71-18964*# General Electric Co., Binghamton, N.Y. Avionic Controls Dept.
STERILIZATION AND ENVIRONMENTAL QUALIFICATION OF A RATE-OF-TURN SENSOR FOR PLANETARY EXPLORATION MISSIONS Final Report
J. N. Russell Aug. 1970 154 p
(Contract NAS1-8885)
(NASA-CR-111853; ACD-9914) Avail: NTIS CSCL 14B

Four solid state sensor packages were manufactured. These units were tested by a qualification test program designed to qualify the units for interplanetary probe missions. Both sterilization and environmental testing were performed on the units. This report includes discussion of each test with supporting test data, and states achievements and failures throughout the program. Author

N71-18971*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT OF AN AUTOMATED VISUAL

SENSITIVITY TESTER

Richard F. Haines, James W. FitzGerald and Salvador A. Rositano Washington Mar. 1971 50 p refs
(NASA-TN-D-6190; A-3651) Avail: NTIS CSCL 14B

An automated visual sensitivity tester is described that determines the observer's visual sensitivity within a 30 deg arc from the fovea as well as the size, shape, and location of the blind spot. A modified super 8-mm movie, back-screen projector is used to present the dynamic visual stimuli in conjunction with an infinity collimating lens, a head positioning support, a response button, an electronic control unit, and a two-pen XYY' response plotter. The present tests use a 10 arc-minute diameter, dim, white spot of light, which is made to travel slowly across the screen along each of 12 meridians, 30 deg apart. This spot disappears at unexpected locations and for each of several preselected durations. The observer is instructed to press the response button each time the spot disappears and release the button when the spot reappears. These responses are recorded by one of the two pens. The second pen records the on-off status and movements of the visual stimulus. Various retinal dysfunctions are assessed by comparing the locations of stimulus and response plots. Preliminary results from administering the device to observers having normal and abnormal visual capabilities indicate that the automated visual sensitivity tester is easy to operate and maintain, is sensitive to the presence of such dysfunctions as scotoma, glaucoma, and changes in retinal sensitivity, and adequately controls the illumination level, image velocity and other stimulus characteristics required. Author

N71-18975*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO MISSION 12 LUNAR PHOTOGRAPHY INDEXES

Mar. 1970 37 p
(NASA-TMX-66883) Avail: NTIS CSCL 14E

Indices of color and black and white lunar photographs taken from the Apollo 12 command service and lunar modules are outlined on MERCATOR projections. J.M.

N71-19019*# Keuffel and Esser Co., Morristown, N.J.

INVESTIGATION MONITORING AND CONTROL OF LARGE TELESCOPE PERFORMANCE

Kent E. Erickson Sep. 1970 250 p refs
(Contract NASw-1856)
(NASA-CR-111811) Avail: NTIS CSCL 17H

In the monitoring technique investigated, a laser interferometer is located at the focal plane of the telescope. A zone pattern, very lightly imprinted on the primary mirror, diffracts a small portion of the light back to the interferometer for monitoring purposes. A holographically produced zone pattern was attained and etched into the surface of an F/5, 12-inch diameter primary mirror in a Cassegranian telescope. Experiments indicate that diffraction loss from the zone plate could be kept below 3 percent and that the background from diffracted light should not obscure stars brighter than approximately magnitude 28. The resulting interference pattern contains information on the total performance of the primary mirror (figure, alignment and focus) as used in the telescope. Author

N71-19021*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.

EXTRATERRESTRIAL CONVERGENT PHOTOGRAMMETRIC MAPPING SYSTEM, AN ERROR ANALYSIS

Milosh Benesh 1 Dec. 1970 46 p refs
(Contract NAS7-100)
(NASA-CR-116824; JPL-TM-33-455) Avail: NTIS CSCL 08B

An effort to define specific photogrammetric parameters that could be incorporated into an extraterrestrial television mapping system through investigations of convergent photogrammetric stereomodels is described. Also described are error analyses of direct and external relative orientation, and practical tests that investigated: aspects of TV image quality and its resulting influence upon mapping accuracy, and the design of an effective analytical method for complex interior orientation calibration. Author

N71-19078 Illinois Univ., Urbana.

SUB-OPTICAL RESONATORS WITH GRATING MIRRORS

Tatsuo Itoh (Ph.D. Thesis) 1969 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 70-882

It has been demonstrated that certain types of diffraction gratings have potential application as coupling mirrors in open resonator systems such as those used in suboptical lasers. Recent experiments have shown that echelette gratings are useful as coupling mirrors because of their sharp blazing property. An analytical technique for solving electromagnetic boundary value problems is applied to this grating problem. The results obtained display several properties of such gratings, such as the P-type anomalies and the proper location of the maximum blazing. The results are accurate and useful for the design of suboptical resonators using the echelette grating as a coupling mirror to achieve a single wavelength operation. Composite resonators using either echelette gratings or strip gratings as coupling mirrors are treated as perturbed eigenvalue problems. It is demonstrated that suitably designed gratings can be used as coupling mirrors without disturbing the resonant field significantly. Dissert. Abstr.

N71-19079# National Center for Atmospheric Research, Boulder, Colo.

SKY BRIGHTNESS PHOTOMETER

T. W. Bilhorn, C. M. Brandsauer, and G. R. Gray Dec. 1970 72 p refs Supported by NSF
(NCAR-TN-53) Avail: Issuing Activity

A sky brightness photometer was developed to make continuous measurements of atmospherically scattered light at a position close to the edge of the solar disk. The instrument was designed for use in field operations at remote, high mountain sites where skies are exceptionally clean and the scattered light intensity is low. The photometer provides reliable, drift-free measurements for long periods of time, and requires minimal shelter and logistic support. Two prototype instruments were built and tested and detailed test results are presented. Author

N71-19087# Israel Program for Scientific Translations, Ltd., Jerusalem.

AN OPTICAL SEISMOGRAPH FOR RECORDING INTENSE DESTRUCTIVE EARTHQUAKES [SEISMOGRAF S OPTICHESKOI REGISTRATSIEI DLYA ZAPISI SILNYKH RAZRUSHITELUYKH ZEMELEIRYASENII]

D. P. Kirnos et al 1970 75 p refs Transl. into ENGLISH from Akad. Nauk SSSR Tr. Inst. Fiz. Zemli, no. 19, 1961 p 25-36 Sponsored in part by NSF Prepared for NSF and NOAA
(TT-70-50123) Avail: NTIS CSCL 08K

The following seismic instruments have been developed in the USSR during the last 10 years for recording intense earthquakes: the SBM seismometer for the assessment of the relationship between earthquake intensity and building damage; the AIS seismometer which should allow a more detailed assessment to be made of the relationship between earthquake intensity and the effect on buildings; the SMR-2 horizontal seismograph, a horizontal pendulum with magnetic damping; the SRZ-1 seismograph with a mechanical recording device and designed to make full recordings of intense earthquakes at a high recording speed. GRA

N71-19131# Lockheed Missiles and Space Co., Palo Alto, Calif.

OPTICAL CHARACTERISTICS OF SCANNING SYSTEMS OF THERMAL VIEWERS

N. I. Kulikovskaia et al 1970 5 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (USSR), no. 10, 1970 p 21–23
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The optical characteristics of scanning by plane mirrors and prisms arranged in both a parallel path and in a convergent beam and scanning by rotating wedges are examined. R.B.

N71-19132# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF SECONDARY RADIATION FLUXES ON THE OPERATION OF AN INFRARED RADIOMETER
M. M. Miroshnikov et al 1970 5 p ref Transl. into ENGLISH from Opt.-Mekh. Prom. (USSR), no. 10, 1970 p 3–6
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The operation of an infrared radiometer affected by fluxes caused by the intrinsic and reflected radiation of elements of the optical system is considered as a function of the change in the temperature of the ambient medium. R.B.

N71-19133# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A COMPUTATION OF THE ENERGETIC RESPONSE OF INFRARED SCANNING APPARATUS
W. F. Soboleva 2 Feb. 1970 3 p refs Transl. into ENGLISH from Optiko-Mekh. Prom. (Leningrad), no. 10, 1970 p 9–11
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A general formula is derived for determining the energy response of an IR scanning apparatus. A graphical interpretation of the formula is given for engineering computations. Author

N71-19136*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DESIGN STUDY FOR A GAMMA RAY SPECTROMETER FOR INTENSE GAMMA FIELDS Final Report
W. E. Austin 10 Dec. 1970 123 p refs
(Contract NAS8-25617)
(NASA-CR-103046) Avail: NTIS CSCL 14B

A gamma ray spectrometer design is presented for use in intense gamma fields of 100 R/hr to 1,000,000 R/hr. A literature survey was conducted and the design approach selected uses Compton scatter attenuation to reduce the flux intensity to values suitable for spectral measurements. Other physical interactions were shown to have little effect on the Compton shifted energy spectrum. Sum-Compton spectral detectors were selected to give pulse height data directly convertable to the gamma spectrum through the detector energy response function and the Compton energy shift. Calculations of the fast neutron flux rate effect on the detectors indicated that flux intensities to 10 to the 9th power n/sq cm-sec could be tolerated. Three Compton targets were used to maintain the count rates between 500 and 10,000/sec over the four decades of incident gamma intensity. The electronic functions are specified and a spectrometer head conceptual design is proposed. The design weighs approximately 130 pounds, largely due to the necessary tungsten alloy shield. Author

N71-19219# Israel Program for Scientific Translations, Ltd., Jerusalem.
A SIMPLE RECORDING INSTALLATION FOR INSTRUMENT OBSERVATIONS IN THE EPICENTER ZONES OF INTENSE EARTHQUAKES [UPROSHCHENNAYA REGISTRATSIONAYA USTANOVKA DLYA INSTRUMENTALNYKH NABLYUDENII V EPISENTRALNYKH ZONAKH SILNYKH ZEMLETRYASENII]
E. Shiyuan et al 1970 8 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Zemli Akad. Nauk SSSR (Moscow), no. 19(186), 1961 p 5–11 Sponsored by NBS and NSF Prepared for NBS and NSF
(TT-70-50122) Avail: NTIS CSCL 08K

To facilitate further study of earthquake-resistant structures, and the delineation of seismic zones and microzones, the observations made at seismic stations should be supplemented by observations made by instruments installed at a large number of points in various seismic zones. The instruments set up at these points should be simple but reliable. Seismoscopes such as types AIS and SBM are the simplest inexpensive instruments but, in addition to these, many of the observation points should be equipped with simple instruments, capable of recording the investigated processes. Author (GRA)

N71-19220# Lockheed Missiles and Space Co., Palo Alto, Calif.
SCANNING SYSTEMS FOR THERMAL VIEWERS
E. Ia. Karizhenskii et al 1970 6 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (USSR), no. 9, 1970 p 39–42
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Peculiarities of detector scanning systems intended for thermal viewers, producing a picture similar to television and operating from a fixed base, are analyzed. The engineering possibilities and advantages of utilizing an alternate-line sweep in these instruments are shown. Fundamental relationships are determined between the output parameters of the thermal viewer, the frequency band of the amplifier channel, and the size characteristics of the scanning system. The value of the coefficient of mirror facet utilization and the possibility of its application as a criterion to estimate the degrees of optimality of the scanning systems of such instruments are shown. Author

N71-19266*# Iowa Univ., Iowa City.
HOUSING QUALITY IN URBAN AREAS: DATA ACQUISITION AND CLASSIFICATION THROUGH THE ANALYSIS OF REMOTE SENSOR IMAGERY
Frank E. Horton and Duane F. Marble (Northwestern Univ.) *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 13 p (See N71-19257 08-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

The potential of photographic sensors to contribute to the analysis and identification of housing quality areas in metropolitan regions is discussed. An analysis was made of ground truth data obtained from a survey conducted in the spring of 1968 covering some 1300 blocks in three districts in the Los Angeles area containing some of the county's worst housing. The imagery analysis consisted of an evaluation of black and white, and color infrared photography obtained as part of NASA Aircraft Mission 73 with respect to the identification of the reduced variable set. Color infrared photography was found to be the most useful in defining the seven variables important in housing quality identification. It is felt that small area classification of housing quality in the United States can be accomplished via aerial photography. Author

N71-19311*# Chicago Univ., Ill. Dept. of Biophysics.
ELECTRON MICROSCOPY IN MICROBIOLOGY AND LUNAR ROCK ANALYSIS Summary Report, Sep. 1969–Dec. 1970
Humberto Fernandez-Moran Dec. 1970 39 p refs
(Grant NGL-14-001-012)
(NASA-CR-116916) Avail: NTIS CSCL 14B

Electron microscopy and electron diffraction instrumentation and techniques are discussed. Applications in microbiology are emphasized, and results in analyzing pyroxenes from lunar rocks are presented. A closed cycle superfluid helium refrigeration unit was installed for operation with the high voltage microscope. High

resolution electron optical systems for data demagnification, storage and retrieval are described. N.E.N.

N71-19317*# Chicago Univ., Ill. Dept. of Biophysics.
DATA REDUCTION FOR INFORMATION RETRIEVAL
Humberto Fernandez-Moran *In its* Electron Microscopy in Microbiol. and Lunar Rock Analysis Dec. 1970 8 p refs Reprinted (See N71-19311 08-14)
Avail: NTIS CSCL 14B

Methods of condensing data for storage and easy retrieval are described. An electron microscope equiped with point cathode sources to provide coherent, bright microbeam illumination is capable of demagnifying by factors of 10,000 to 100,000. A closed-cycle, liquid helium II refrigerator was installed to enable operation in the 1.85 to 2.0 K range. Holography is also mentioned as a useful tool for information retrieval. It is pointed out that the ultimate goal is to duplicate the fine structure of the nervous system down to the molecular level, but an application of microprojectors, or picolibraries, onboard satellites is mentioned. N.E.N.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-18254# Battelle Memorial Inst., Columbus, Ohio.
SURVEY REPORT ON STRUCTURAL DESIGN OF PIPING SYSTEMS AND COMPONENTS
E. C. Rodabaugh and A. G. Picket (Southwest Res. Inst.) Dec. 1970 56 p refs Sponsored by AEC Prepared for ORNL
(TID-25553) Avail: NTIS HC $6.00/MF $0.95

A summary of design practices, service experience, and research work on the structural design of piping components and systems is presented to provide a background and direction for future work. The analysis is restricted to structural design aspects of metal piping systems. The information is presented on factors involved in structural design, analytical methods, failures, standards, straight pipe welds, curved pipes and miters, connections, reducrs, valves and pumps, supporting elements, thermal stresses, and dynamic effects. NSA

N71-18265# California Univ., Livermore. Lawrence Radiation Lab.
PLUGGING OF HIGH EFFICIENCY FILTERS BY WATER SPRAY
Jack Murrow Aug. 1970 9 p Sponsored by AEC
(UCRL-50923) Avail: NTIS

That water droplets plug high efficiency filters was proved by a series of filter plugging tests using various spray droplet sizes and water volumes. A coarse spray generated by an automatic sprinkler spray head eroded the filter until it was breached. Tests were performed on new clean filters. Used filters, with dusts and chemical on their surfaces, are expected to be affected to a greater degree. Author (NSA)

N71-18284# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
LOW TEMPERATURE MATERIALS TEST RIG AND SOME TYPICAL DATA
A. J. Middleton May 1970 18 p refs
(RHEL/R-202) Avail: AEC Depository Libraries; UK 3s 6d

A machine for testing engineering materials at low temperature is described and some tensile, compression, thermal contraction, and electric resistivity data at 77K and 4.2K are listed. Author (NSA)

N71-18324# Oak Ridge National Lab., Tenn. Reactor Div.
HYDRAULIC PERFORMANCE AND CAVITATION CHARACTERISTICS OF AN ELECTROMAGNETIC HELICAL INDUCTION PUMP OPERATING WITH POTASSIUM AND PREDICTION OF PERFORMANCE WITH LITHIUM AT 2200 F
H. C. Young and D. L. Clark Nov. 1970 55 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2995) Avail: NTIS

An electromagnetic helical induction pump with a cell fabricated from the high-temperature refractory tantalum alloy T-111 was operated with potassium at temperatures up to 1500 F and at flow rates from 0 to 8 gpm. The hydraulic performance of the test pump with potassium was used as the basis for predicting performance at 2200 F with lithium. Data obtained during subsequent successful operation with lithium showed the prediction to be slightly conservative. Data taken during operation with potassium indicated a reduction in the net positive suction head required to suppress cavitation inception for operation with degassed potassium in comparison with operation with argon in the system surge tank. Author (NSA)

N71-18328# Mechanical Technology, Inc., Latham, N.Y.
LIQUID METAL BEARINGS TECHNOLOGY FOR LARGE, HIGH TEMPERATURE SODIUM ROTATING MACHINERY
Progress Report, 1 May –31 Jul. 1970
E. B. Arwas, L. Hoogenboom, C. Kissinger, R. Newell, T. Smalley et al 31 Jul. 1970 53 p refs
(Contract AT(30-1)-3930)
(NYO-3930-8; MTI-70-TR-64) Avail: NTIS

Activities in programs directed toward design and development of Na-lubricated bearings for high capacity Na pumps used in fast breeder reactors are summarized. Check-out of the computer program for calculation of the performance of large, turbulent, externally-pressurized bearings was completed. Optimization calculations to establish bearing and restrictor geometry that provide maximum fluid film stiffness and maximum film damping were conducted. Calculations of fluid film stiffness, damping, and flow for both optimum and off-optimum bearing designs were completed. Initiation of production calculations to generate the bearing performance tables for inclusion in the design handbook is reported. Work was continued on installation of the 12 in. diameter, self-acting sodium lubricated bearing test rig. Analyses of the results of the screening-type corrosion tests of bearing surface materials after exposure to 1100 F sodium were completed. NSA

N71-18336# California Univ., La Jolla. Dept. of Physics.
CONTINUOUSLY OPERATING He 4 EVAPORATION REFRIGERATOR
L. E. De Long, O. G. Symko, and J. C. Wheatley [1969] 19 p refs
(Contract AT(04-3)-34)
(UCSD-34-P-143-31) Avail: NTIS

A simple and compact device was developed to provide continuous, self-regulating refrigeration at approximately 1.3 K. The temperature of the device remains nearly constant, independent of external power, up to a critical power. For a flow rate of 0.0001 moles/sec, the refrigerator can absorb 4.5 mW. Such a refrigerator should be suitable for condensing helium 3 in a helium 3 helium 4 dilution refrigerator. Author (NSA)

N71-18396# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

IMPROVEMENT OF DEVICES FOR DETECTION OF LEAKS USING HELIUM AS A TRACER [PERFECTIONNEMENT AUX DISPOSITIFS DE DETECTION DE FUITES UTILISANT L'HELIUM COMME GAZ TRACEUR]

P. Roubeau and P. Maillard 1969 6 p refs In FRENCH Presented at Intern. Conf. on Vacuum and Cold, Grenoble, France, 2–5 Dec. 1969

(CEA-CONF-1506; CONF-691210-2) Avail: AEC Depository Libraries

An apparatus is described for the detection of leaks using helium as tracer. The apparatus consists essentially of a cartridge of activated vegetable carbon, several grams in weight, cooled to the temperature of liquid helium, through which all gases pass in going to the leak detector. By adsorption at 77 K, the activated carbon stops all the gases but helium completely and without appreciable delay. The operational principles of the device are outlined and the results show it improves the detection of leaks. NSA

N71-18410*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EFFECTS OF CONTAINER GEOMETRY ON VACUUM EVAPORATION TESTS OF LIQUID LUBRICANTS

Carl L. Haehner Jan. 1971 30 p refs Submitted for publication

(NASA-TM-X-65455; X-764-71-55) Avail: NTIS CSCL 11H

An empirical equation is developed from vacuum evaporation tests on two lubricating fluids which relates to container geometry. Methods of presenting data are discussed which caution against use of percent to describe weight loss of a fluid in vacuum. Data from numerous tests are presented in various forms resulting in a more effective comparison contant better suited in selecting lubricants for space applications. Author

N71-18489# National Bureau of Standards, Washington, D.C.

THE INTERNATIONAL SYSTEM OF UNITS (SI)

Chester H. Page et al, ed. Jan. 1971 46 p refs Transl. into ENGLISH of the book 'Le Systeme International d'Unites' Paris: OFFILIB, 1970 Prepared jointly with Natl. Phys. Lab.

(NBS-SP-330) Avail: SOD $0.50

Resolutions and recommendations of the General Conference of Weights and Measures on the International System of Units are presented. Explanations as well as relevant extracts from the recommendations are included for the practical use of the system. The SI units, including base units, derived units, and supplementary units, are defined and the symbols used for these units are given. In addition, the measurements are outlined which metrological laboratories can make to realize the units and to calibrate precision material standards. D.L.G.

N71-18537# Colorado Univ., Boulder. Dept. of Electrical Engineering.

GENERALIZED ANALYTICAL COMPUTER PROGRAM FOR TURBOMACHINE-DRIVEN CRYOGENIC SYSTEMS IN HELIUM

F. Edward McDonald Jun. 1970 277 p refs

(Contract DA-44-009-AMC-787(T))

(AD-715724) Avail: NTIS CSCL 10/1

The work comprises a generalized computer program for the performance analysis and study of turbomachine-driven cryogenic systems in general, employing helium as the working fluid. With the facility of the broad input spectrum incorporated, the effect of numerical changes in all major variables or input parameters may be studied, either individually or in combination as desired. Systems may also be optimized for minimum size, weight, number of components, and power input requirements.....by judicious selection of the various input parameters. The porous-plate type heat exchanger is specifically considered. Upon activating either one of two input codes, the computer will evaluate heat exchanger characteristics based on use of either AL-1100-F or AL-3003-F as the plate material. Author (GRA)

N71-18579* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METHOD OF MAKING TUBES Patent

John J. Park, inventor (to NASA) Issued 9 Sep. 1969 (Filed 30 Dec. 1966) 5 p Cl. 72-364; Int. Cl. B21d31/00; Int. Cl. B21c17/06; Int. Cl. C21d7/14

(NASA-Case-XGS-04175; US-Patent-3,465,567; US-Patent-Appl-SN-606464) Avail: US Patent Office CSCL 13H

One end of a relatively long thin flat strip of metal is formed into a substantially circular cross section about its long axis. The circular end is then inserted through a glass forming tube so that the metal strip is restrained in the shape of the forming tube. The restrained strip is heated at a sufficient temperature and for an adequate time so that the strip retains a tubular shape about its long axis when unrestrained by the forming tube. Official Gazette of the U.S. Patent Office

N71-18580* TRW Systems, Redondo Beach, Calif.

MULTIPLE ORIFICE THROTTLE VALVE Patent

Louis A. Rosales and John A. Fitton, Jr., inventors (to NASA) Issued 6 Oct. 1970 (Filed 17 Jan. 1968) 6 p Cl. 138-45; Cl. 138-4; Cl. 251-118; Cl. 251-121; Int. Cl. F15d1/02 Sponsored by NASA

(NASA-Case-XNP-09698; US-Patent-3,532,128; US-Patent-Appl-SN-698592) Avail: US Patent Office CSCL 13K

A throttle valve comprising a series of spaced plates with aligned orifices is described. Short bellows connecting adjacent plates permit the plates to move together enabling a large fluid flow, or move apart restricting the fluid flow. Official Gazette of the U.S. Patent Office

N71-18587# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section de Construction Metallique.

COLD SHEARING OF STEEL PLATES AND THEIR EMBRITTLEMENT IN WELDED JOINTS [LE CISAILLAGE A FROID DES TOLES D'ACIER ET LEUR FRAGILISATION DANS LES ASSEMBLAGES SOUDES]

Jean Martelee and Marcel Hofmans Nov. 1970 82 p refs In FRENCH Sponsored by IRSIA Prepared jointly with Centre Natl. de Rech. Metallurgiques

(CRIF-MT-66) Copyright. Avail: NTIS

The influence of the method of preparation of the edges of flat steel plates, which are to be butt welded, is discussed. Planing and shearing of AE 26D and AE 36D are discussed in connection with different welding methods. Special attention must be paid when shearing the edges of AE 36 D, whereas with AE 26D sheets shearing has no influence on the qualities of the weld. ESRO

N71-18604# Rome Univ. (Italy). School of Aerospace Engineering.

DYNAMICS OF FLUID RING DAMPERS FOR AEROSPACE APPLICATIONS [DINAMICA DEGLI SMORZATORI AD ANELLO FLUIDO PER APPLICAZIONI SPAZIALI]

Carlo Arduini Jun. 1970 24 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 28

Avail: NTIS

Dampers on board spacecraft are required to eliminate undue oscillatory motions which would otherwise remain for a long time due to the limited intrinsic damping. The fluid ring damper is a toroidal pipe filled with viscous fluid, which dissipates the energy of the relative motion induced by the transport accelerations. The damping torque of this device is an integral function of the acceleration, which cannot be reduced to the classic linear damping (proportional to the velocity). This analysis, on a system with a single degree of freedom, demonstrates that the motion under this type of torque can be expressed as a damped harmonic motion plus an infinite series of aperiodic "transients" of decreasing

amplitude and attenuation. The damping coefficient of the "asymptotic" motion is derived as a function of a characteristic Reynolds number and of the inertia ratio between fluid and rigid masses. Useful expansions up to the second order in the inertia parameter are also derived. Author (ESRO)

N71-18605# Louvain Univ. (Belgium). Inst. of Mechanical Manufacturing.
SONIC TESTING OF GRINDING WHEELS
Albert Decneut (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.), Raymond Snoeys, and Jacques Peters Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Nov. 1970 30 p refs Sponsored by IRSIA
(CRIF-MC-36) Copyright. Avail: NTIS

Various conventional grinding wheel hardness measuring instruments are based on ill-defined physical properties and fail to give mutually coherent results. A fast and absolutely nondestructive test procedure using the Grindo-Sonic hardness measuring equipment is described. The numerical result, obtained in a matter of seconds, is directly converted into Young's modulus of elasticity which is related to the rigidity of the grinding wheel material. It is shown that it gives a reliable indication of the grinding wheel at work. Author (ESRO)

N71-18613* General Dynamics/Astronautics, San Diego, Calif.
DETERMINATION OF SPOT WELD QUALITY Patent
Charles J. Kropp, inventor (to NASA) Issued 9 Sep. 1969 (Filed 6 Jul. 1966) 4 p Cl. 219-91; Int. Cl. B23k11/10 Sponsored by NASA
(NASA-Case-XNP-02588; US-Patent-3,466,418; US-Patent-Appl-SN-563644) Avail: US Patent Office CSCL 13E

A nondestructive method of radiographically inspecting a resistance weld is described. The weld region between work pieces is surrounded with a sheet of material having a substantially different radiopacity, such as stainless steel and nickel, respectively. The pieces are resistance welded to form a nugget surrounded by an unfused portion of the sheet forming an interfacial boundary. A radiographic image of the weld region is then formed which includes a line image of the interfacial boundary. Official Gazette of the U.S. Patent Office

N71-18616* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONTROLLED GLASS BEAD PEENING Patent
Charles R. Manning, Jr., Thomas T. Bales, Wayne B. Lisagor, and Marion B. Seyffert, inventors (to NASA) Issued 6 Oct. 1970 (Filed 31 Aug. 1967) 11 p Cl. 72-53; Int. Cl. B21j5/00
(NASA-Case-XLA-7390; US-Patent-3,531,964; US-Patent-Appl-SN-665681) Avail: US Patent Office CSCL 13H

A method and apparatus are described for inducing compressive stresses in a pressure vessel to prevent stress corrosion. The apparatus consists of a mechanism for rotating the pressure vessel while a lance, having a nozzle supplied with beads, traverses the entire inside surface of the vessel, uniformly peening the material to introduce the stress. Official Gazette of the U.S. Patent Office

N71-18630*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF CYLINDRICALLY HOLLOW (DRILLED) BALLS IN BALL BEARINGS AT DN VALUES TO 2.1 MILLION
Harold H. Coe, Herbert W. Scibbe, and William J. Anderson Washington Mar. 1971 17 p refs
(NASA-TN-D-7007; E-5889) Avail: NTIS CSCL 13I

An experimental investigation was conducted with 75-mm bore bearings using hollow (drilled) balls as the rolling elements. Similar bearings using solid balls were also tested and the data compared. The bearings were operated with a 500-lb thrust load at shaft speeds up to 28,000 rpm. The torque and temperature of the bearings with the drilled balls (50 percent weight reduction) were significantly lower than those of the solid ball bearings. No test bearing failures occurred with total running times of up to 107 hrs. Author

N71-18700# Army Materials and Mechanics Research Center, Watertown, Mass.
FEASIBILITY STUDY OF REFRACTORY BASE WELD-BACKING MATERIALS
George J. Snyder Oct. 1970 35 p refs
(AD-715856; AMMRC-TR-70-30) Avail: NTIS CSCL 13/9

The report describes the investigation of a promising weld-backing method where common, refractory-base mixtures are consolidated into expendable replica preforms of any required joint underside-contour by thermally responsive binders. Such preforms then serve as supporting cushions for the root bead, particularly during arc-side butt-joining operations. Ease of installation before welding and ready removal after welding help to promote simplification of welding cycle, whereas other capabilities of the backing include a mass production method of manufacture and survival of long-term storage with deterioration. In this investigation, the method was applied in conjunction with automatic GMA and GTA processes to the preparation of a series of longitudinal butt welds. Individual effects of operational parameters upon root-bead penetration behavior were explored with each of a wide variety of joint configurations. These were of mild- or low-alloy steel origin, either 1/4, 1/2, or 1 inch in thickness. In each case, fully penetrated deposits were obtained once suitable operational requirements had been established. Author (GRA)

N71-18701* North American Aviation, Inc., Downey, Calif.
EXTENSIBLE CABLE SUPPORT Patent
David J. McHaffie, inventor (to NASA) Issued 3 Jun. 1969 (Filed 27 Jun. 1967) 5 p Cl. 317-122; Int. Cl. H02b9/00 Sponsored by NASA
(NASA-Case-XMF-07587; US-Patent-3,448,348; US-Patent-Appl-SN-649359) Avail: US Patent Office CSCL 13E

A means for supporting a flexible conductor cable between drawers or racks holding electronic equipment and the cabinet assembly that houses the drawers or racks is described. A track is installed beneath a drawer and extends the length thereof and somewhat behind the drawer and a plurality of swiveled clamp assemblies slide on the track. The cable folds in a sinuous pattern from side to side of the track and is clamped by the swiveled clamps at intervals where it crosses the track transversely. When the drawer travels in and out of the cabinet the cable is permitted to fold and unfold while remaining firmly clamped to the sliding swiveled clamps thus keeping the cable well supported and preventing entanglement, chafing, and twisting. Official Gazette of the U.S. Patent Office

N71-18737*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PARALLEL GAP WELDING KOVAR RIBBONS TO COPPER CONDUCTOR PRINTED WIRING BOARDS
G. E. McDaniel Washington Mar. 1971 34 p refs
(NASA-TN-D-6236; M-654) Avail: NTIS CSCL 13H

Preliminary screening tests considering several copper conductor sizes, and ribbon sizes were studied. Several successful combinations were derived. Results showed that parallel gap welding Kovar ribbon to copper conductors is feasible but is highly dependent upon the overplating type and thickness. Author

N71-18920# Western Gear Corp., Lynwood, Calif. Research Dept.
PRECISION FORGING OF SPIRAL BEVEL GEARS FOR

ARMY HELICOPTERS Final Report, Jan. 1968–Apr. 1970
Millard R. Berger 15 Sep. 1970 81 p
(Contract DAAJ01-68-C-1446)
(AD-715419; Rept-7003-310) Avail: NTIS CSCL 13/8

The objective of the project was to develop an alternate manufacturing method for spiral bevel gears used in Army helicopters. The report covers the technical description of a program to develop high velocity forging techniques to produce spiral bevel gears to pre-grind tolerances. Initial objectives were to obtain as-forged gears with .005 inches excess material on the side of each tooth for finish grinding after the heat treating. The report includes a discussion of die design parameters, the manufacturing techniques for dies, forging parameters, dimensional checks of the forged gears, machining techniques for determining as-forged geometry and macroscopic and microscopic metallurgical data showing grain flow and micro-structure. Also included is a discussion of difficulties experienced and recommendations for future investigations. Author (GRA)

N71-19009*# Translation Consultants, Ltd., Arlington, Va.
THE SERVICE LIFE OF BALL BEARINGS [DIE LEBENSPAUER VON KUGELLAGERN]
A. Palmgren Washington NASA Mar. 1971 11 p refs Transl. into ENGLISH from Z. Ver. Deut. Ingr., v. 68, no. 14, Apr. 1924 p 339–341
(Contract NASw-2038)
(NASA-TT-F-13460) Avail: NTIS CSCL 13I

The durability and service life of ball bearings cannot be established dependably either through tests on conventional samples of materials or through mathematical calculations. Only tests performed on complete bearings will yield results. Equations were established on the basis of such tests that can be used to determine bearing life under purely radial loads, composite loads, and under alternating load intensities over time. The service life of a ball bearing exposed to axial or composite loads is determined in part by the greater ball pressure that results and in part by the fatigue phenomena which are subject to change, compared to conditions prevailing under purely radial loads. Author

N71-19028 Kansas State Univ., Manhattan.
PARTICLE BOUNCE AND AIR FILTRATION THEORY
Jason Carl Annis (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-21116

A theory was developed for mechanical filtration where bounce is a significant factor. It states that the distance a particle travels into a filter before collection is a log-normally distributed random variable. An equivalent statement of this theory is that filter efficiency plots as a cumulative log-normal distribution against filter depth. Therefore, on logarithmic-probit graph paper, a straight-line relationship exists between efficiency (or penetration) and depth. The particle bounce filtration theory was confirmed by a series of experiments covering a range of particle size, particle surface configuration, fiber size, fiber type, density of fiber packing and filter air velocity. It was possible to achieve a high degree of correlation between the log-normal distribution parameters and filtration parameters. Using the correlation equations, data on this single point can also yield efficiencies for other particle sizes and types of fibers. Dissert. Abstr.

N71-19080# Purdue Univ., Lafayette, Ind.
TIME DEPENDENT PRESSURE FIELD BENEATH A GAS LEVITATED DISK
J. T. Pearson and W. S. Bradfield (State Univ. of New York, Stony Brook) [1969] 7 p refs
Avail: Issuing Activity

A viscous dominated incompressible theory is developed which describes the dynamic velocity and pressure fields in the film beneath a fluid levitated disk in vertical motion due to an initial perturbation from equilibrium or the application of an external force. Author

N71-19081# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
LAMINAR AND TURBULENT FILM THICKNESS RELATIONS FOR CIRCULAR HYDROSTATIC THRUST BEARINGS
D. K. Warriner and J. T. Pearson [1969] 27 p refs
Avail: Issuing Activity

Equations related to film thickness, load, mass flow rate, fluid properties, and bearing geometry are obtained for laminar, laminar-turbulent, and turbulent incompressible flows in recessed, plane-surfaced circular hydrostatic bearings having a single central supply of fluid. The theory accounts for the laminarization of the lubricant in either the recess or the lubricating film. The order of magnitude of the effects of bearing rotation and fluid inertia are examined. The general equations are solved for the case of negligible effects from bearing rotation. This solution compares favorably with the available experimental data for a bearing without recess. The results are set forth in nondimensional parameters. Author

N71-19134*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
FACTORIAL STUDY OF REMOTE MANIPULATION WITH TRANSMISSION TIME DELAY
James Hampton Black, Jr. (M.S. Thesis) Dec. 1970 76 p refs
(Grant NGL-22-009-002)
(NASA-CR-116894; DSR-70283-16) Avail: NTIS CSCL 13I

The effect of a transmission time delay on the performance of manipulation tasks with a six degree of freedom master-slave manipulator was studied. Task completion time was the measure of operator performance. A feedback delay of 3.5 seconds was generated by video tape. Three subjects were tested on three manipulation tasks, each having a large and small scale. For purposes of analysis the tasks were segmented into three components: get, transport, and position. Completion times for the total task and for the segments were measured and in the case of delay, the observed number of waits for feedback was recorded. The study confirms that six degree of freedom manipulation is possible and effective with a move and wait strategy. Analysis of the data shows that delay most affects the portions of the task requiring greatest precision; feedback delay consistently increases the fraction of the total task time required by the position segment. Author

N71-19169 IIT Research Inst., Chicago, Ill.
OPTIMUM PERFORMANCE CHARACTERISTICS AND SYNTHESIS OF SHOCK ISOLATION SYSTEMS
Anthony John Kalinowski (Ph.D. Thesis) 1969 176 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 70-1096

A general formulation encompassing several different design-oriented problem types within the framework of mathematical programming is established and practical solution techniques are identified. The computational formulations presented for large size systems are valid for a broad class of systems which possess a certain quasi-linear property and represent a wide range of practical problems. Less restrictive formulations are also given for systems not possessing this property; however, in these the problem size is limited in the number of degrees-of-freedom that can be handled. From an applications point of view, two problem classifications are considered: (1) response limits of shock isolation systems and (2) optimal synthesis of shock isolation systems. Dissert. Abstr.

N71-19180# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE DYNAMICS OF A FATIGUE TESTING MACHINE
S. V. Serensen et al 1970 377 p refs Transl. into ENGLISH from the book "Dinamika Mashin Dlya Ispytanii Na Ustalost" Moscow, 1967 451 p Sponsored by NBS and NSF Prepared for NBS and NSF
(TT-70-50033) Avail: NTIS HC$6.00/MF$0.95 CSCL 14B

The dynamics of fatigue testing machines are presented. Subjects discussed are: (1) excitation systems for fatigue testing machines, (2) errors in determining the loads during fatigue tests, (3) efficiency of dynamic load excitation, (4) load stability, (5) magnetostrictive and peizoelectric excitation, and (6) selection of parameters of mechanical systems in accordance with test conditions. GRA

N71-19200# Israel Program for Scientific Translations, Ltd., Jerusalem. National Bureau of Standards, Washington, D.C.
ELECTRODEPOSITION OF METALS [ISSLEDOVANIYA V OBLASTI ELEKTROOSAZHDENIYA METALLOV]
1970 158 p refs Transl. into ENGLISH of 'Proceedings of the 10th Lithuanian Conference of Electrochemists held on 12 – 13 December 1968' Vilnyus, Akad. Nauk Lit. SSR, 1968 Sponsored by NBS and NSF Prepared for NBS and NSF
(TT-70-50037) Copyright. Avail: NTIS CSCL 13H

The proceedings of a conference on electrochemistry and electrodeposition of metals are presented. The conference provides for the exchange of experience between scientists and industrial workers. The conference serves to extend the field of theoretical and practical problems of electrodeposition of metals so as to produce electrodeposits of the desired properties. Author (GRA)

N71-19213* Rocketdyne, Canoga Park, Calif.
TEMPERATURE SENSITIVE FLOW REGULATOR Patent
Lloyd E. Tomlinson, inventor (to NASA) Issued 27 Oct. 1970 (Filed 27 Dec. 1968) 3 p Cl. 138-43; Int. Cl. F15d1/02 Sponsored by NASA
(NASA-Case-MFS-14259; US-Patent-3,536,103; US-Patent-Appl-SN-787410) Avail: US Patent Office CSCL 20D

A device is described for changing the flow rate of a fluid in a duct in response to a change in temperature. The device permits a uniform flow through a fixed orifice in the duct and a variable flow through holes in the walls of two nested metallic sleeves of truncated cone structure. The device is constructed of metallic materials having different thermal expansions arranged to cause the sleeves to slide and change diameter relative to each other in response to temperature changes. The relative movement of the sleeves varies the amount of flow space area through the walls of the sleeves. Official Gazette of the U.S. Patent Office

N71-19214* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE MANUFACTURING MACHINE Patent
Hans F. Wuenscher, inventor (to NASA) Issued 20 Oct. 1970 (Filed 28 Apr. 1969) 8 p Cl. 244-1; Int. Cl. B64g1/00
(NASA-Case-MFS-20410; US-Patent-3,534,926; US-Patent-Appl-SN-819599) Avail: US Patent Office CSCL 13I

An apparatus is described for various manufacturing operations in the low and zero gravity environment of orbital space flight. The machine includes a cylindrical tank-like capsule in which manufacturing operations are carried out. An environmental control system is provided for controlling the atmosphere and pressure within the capsule. High and low frequency coils along with electrostatic field coils are mounted in the capsule for positioning, spinning transporting, and agitating materials being processed in the capsule. Heating devices are included for melting materials and various probes are provided for adding liquid or gaseous materials to the workpieces being processed. A mixing apparatus is included for preparing and placing mixtures of materials in the capsule for processing. Official Gazette of the U.S. Patent Office

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-18445# European Space Research Inst., Frascati (Italy).
LONG TERM FREQUENCY STABILIZATION OF A COMPOSITE-CAVITY ARGON LASER USING A REFERENCE FREQUENCY LIGHT SOURCE
K. Maischberger Dec. 1970 27 p refs Submitted for publication
(ESRIN-IN-117) Avail: NTIS

A commercial argon laser has been modified to radiate at a highly stable single frequency over a long time period. Single frequency operation is achieved by replacing one broadband mirror with a 3-mirror cavity. The long term stability is obtained by keeping the mirror separation of the 3-mirror cavity constant, using the wavelength of a stabilized commercial He-Ne laser as the absolute length standard. As a result the argon laser emits a maximum power of 450 mW at 4880 A with a relative frequency stability over one half hour operation. Author (ESRO)

N71-18451# European Space Research Inst., Frascati (Italy).
STATIONARY COLLISIONAL SHOCKS IN A Q-DEVICE WITH A HOMOGENEOUS MAGNETIC FIELD
C. Bartoli and M. Bitter Nov. 1970 20 p refs Submitted for publication
(ESRIN-IN-112) Avail: NTIS

Stationary collisional shock formation in a Q-device has been studied (n approximately from 10 to the 10th power to 10 to the 11th power/cu cm) in a homogeneous B-field configuration, by means of an experimental set-up which allows a continuous variation of the Mach number. The dependence of the shock parameters on the Mach number has been investigated and compared with the theoretical results obtained from the Rankine-Hugoniot equations. Author (ESRO)

N71-18533# Army Foreign Science and Technology Center, Washington, D.C.
SPECTRAL ANALYSES OF GLOW-DISCHARGE PLASMA USED IN CO2 LASER [SPEKTRALNYE ISSLEDOVANIYA PLAZMY TELEYUSHCHEGO RAZRYADA, PRIMENYAEMOGO J OKG NA CO2]
E. N. Lotkova et al 1 Sep. 1970 8 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (USSR), v. 9, no. 4, 1968 p 704 – 705
(AD-715355; FSTC-HT-23-098-70) Avail: NTIS CSCL 20/5

The spectral composition of the emission of glow-discharge plasma used in the CO2 laser was analyzed. The emission spectra in the discharge were investigated both under the conditions of the flow system and in the stationary system. The discharge was ignited in a tube made of molybdenum glass with aluminum electrodes and flat windows made of fused quartz on the ends. Discharge feed was accomplished with 30-50 ma direct current at about 7 kv. Author (GRA)

N71-18614* Massachusetts Inst. of Tech., Cambridge.
METHOD AND APPARATUS FOR STABILIZING A GASEOUS OPTICAL MASER Patent
Ali Javan and Koichi Shimoda, inventors (to NASA) Issued 23 Jun. 1970 (Filed 24 Oct. 1965) 11 p Cl. 331-94.5; Int. Cl. H01s3/00 Sponsored by NASA
(NASA-Case-XGS-03644; US-Patent-3,517,328; US-Patent-Appl-SN-505320) Avail: US Patent Office CSCL 20E

The scheme for long term frequency stability of a gas laser uses the position of mirrors in an optically resonant cavity to control the frequency and the laser operating level. Closed loop

controls provide detection of the second derivative of the modulated beam for control of excitation energy, detection of the third derivative for control of average separation, and detection of the first derivative for control of tilt angles. The frequency is stabilized on the center frequency of the atomic resonance of the gas. N.E.N.

N71-18653# New Mexico State Univ., University Park.
VARIATION OF REFRACTIVE INDEX DURING LASER OPERATION Final Report, 1 Jun. 1963 – 31 May 1968
Jerald R. Izatt 1 Jun. 1970 137 p refs
(Contract Nonr-3531(04))
(AD-715412) Avail: NTIS CSCL 20/5

The effect on the efficacy of the Kronig-Kramers relations of non-Boltzmann population distributions established by optical pumping in pink ruby has been studied. The technique employed uses a ruby laser source which is frequency scanned across the RI region of anomalous dispersion. The sample is in the form of a Fabry-Perot etalon and refractive index changes are determined from shifts in the fringe pattern which it produces. The experiments are conducted at liquid nitrogen temperature, and the sharpness of the RI absorption structure at 77K has made it necessary to investigate the mode structure of the source laser and perform a complicated source-structure correction on the index measurements, or alternatively, to develop a single-mode, tunable, ruby laser source. Both approaches have been used. The occurrence of significant ground state depletion in some of the experiments and the substantial perturbation of the observed absorption profile produced even by very weak off-center modes make the simultaneous observation of the absorption and refractive index profiles necessary. A second method of measuring anomalous dispersion using a Babinet compensator has also been employed. The experiments are still in progress and the report discusses the techniques which have been developed and describes pertinent experimental observations rather than presenting definitive data correlating the real and imaginary parts of the complex refractive index of an optically pumped sample. Author (GRA)

N71-18766# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
INFRARED DIFFERENCE FREQUENCY GENERATION USING A TUNABLE DYE LASER
C. Forbes Dewey, Jr. and Lon O. Hocker Oct. 1970 15 p refs
(Contract N00014-67-A-0204-0040); ARPA Order 322)
(AD-715780; PUB-70-11) Avail: NTIS CSCL 20/5

Intense infrared radiation has been produced in the 3 to 4 micrometer region by generating the difference frequency between a wavelength-tunable dye laser and a -switched ruby laser. Saturation of the conversion of ruby photons to sum-and-difference frequencies was observed on a single pass through a phase-matched LiNbO3 crystal. The system appears to be attractive as a simple, highly-efficient, and broadly-tunable infrared source. Author (GRA)

N71-18885# Bell and Howell Research Center, Pasadena, Calif. Electronic Materials Div.
INDIUM ARSENIDE PHOSPHIDE INJECTION LASERS Final Technical Report, Jun. 1969 – Aug. 1970
Alan G. Thompson and Bernd Ross Oct. 1970 76 p refs
(Contract N00014-69-C-0415; ARPA Order 306; Proj. Defender)
(AD-715454; TR-6) Avail: NTIS CSCL 20/5

The indium arsenide-phosphide alloy system has been studied. Indium arsenide and indium phosphide compounds were prepared by pulling and directional freezing respectively. The InP ingots were characterized for distribution coefficients and electrical properties. Ingots of InAs(1-x)P(x) were pulled by two modifications of the Czochralski technique--an all-quartz sealed system and pulling through a liquid encapsulant. The two methods are compared and the latter found to be superior for these alloys. Electrical, X-ray and mass spectrometric measurements were made on the alloy ingots. Laser diodes were fabricated in a similar manner to those reported on previously, with power outputs up to 0.5W at 1.06 micrometer with better than 1% efficiency being obtained under pulsed conditions close to 100K. Amplification of the 1.06 micrometer emission from an InAs(1-x)P(x) laser diode was demonstrated in a Nd-doped glass fiber, showing a system gain of 50,000. Author (GRA)

N71-18982*# GCO, Inc., Ann Arbor, Mich.
VIBRATION, FLUTTER, AND TRANSIENT ANALYSIS USING HOLOGRAPHIC METHODS Final Report
30 Jun. 1970 77 p
(Contract NAS8-21369)
(NASA-CR-103053; GCO-70001) Avail: NTIS CSCL 20E

The application of holographic interferometric methods to vibration, flutter, and transient analysis of thin, metallic panels to be used in space stations was investigated. The panels were simulated by various aluminum and steel panels which were studied using time average holography to determine mode shape of the vibrating panel. Real time holography was used with special phase shifting techniques to determine phase of the vibrating panels. Transient response analysis was done with real time holography and a high speed camera. Time average holography was shown to be a useful tool in determining vibrational mode patterns of a panel. Mode patterns on vibrating objects were shown to agree with the theory. Amplitude measurement from the holographic data was verified using an optical interferometer to measure amplitude at the center of the vibrating plate. The agreement of these two measurements was very good. The technique was also applied to a thin walled cylinder. Author

N71-19095# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REMOTE POSITION MEASUREMENT USING LASER OPTICS
J. D. Jensen 28 May 1970 14 p Presented at the Conf. on Electron. Instrumentation, Moscow, Idaho
(BNWL-SA-3335; CONF-700542-1) Avail: NTIS

A simple interferometric technique for measuring the degree of surface finish of flat machined parts is reviewed, emphasizing the monochromatic light division into two separate beams, as reflected and reference beams. The optical heterodyning measurement system is described, using a one milliwatt helium-neon laser. Noise signal problems due to vibration of various system components are considered. System applications are ascertained for standard meteorology, surface finish measurement, and dimensional measurement. J.A.M.

N71-19163 Rensselaer Polytechnic Inst., Troy, N.Y.
INVESTIGATION OF ARGON ION LASING ACTION IN A HOLLOW CATHODE DISCHARGE
William Charles Jennings (Ph.D. Thesis) 1969 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 70-2665

The hollow cathode discharge (HCD) is shown to be a suitable energy source for argon ion lasing action. Two HCD systems were successfully operated, the data reported comprising the first catalogue of the behavior of HCD ion laser systems. A third laser system employing a conventional, externally heated oxide cathode was constructed to allow a direct comparison of the two energy sources. In an unconfined mode of operation, the HCD systems appeared to display distinct behavioral differences from conventional systems. However, a comparison of the HCD and conventional systems in a confined mode reveals that the macroscopic behavior of the two energy sources is nearly identical.

Experimental data on the HCD argon ion laser are compared with calculations based on a theoretical analysis which includes the effects of radiation trapping. The increasing influence of electron-ion interactions at high currents is demonstrated. Dissert. Abstr.

N71-19181 Stanford Univ., Calif.
PLASMA REFRACTIVE EFFECTS IN FAR INFRARED LASERS
Bruce Wayland McCaul (Ph.D. Thesis) 1969 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 70-1574

In pulsed HCN lasers the plasma electrons, which are more dense near the axis of the discharge, constitute a temporary divergent refractive element. The effect is strong in far infrared lasers since the radiation frequency is relatively close to the plasma resonance frequency of typical laser discharge plasmas. Using a ray matrix approach and a parabolic radial electron density distribution, the laser beam diameter and the constriction of stable-cavity mirror curvatures are calculated as a function of electron density. These results are compared to measurements of cavity stability using a variable-curvature laser mirror and to measurements of the electron density using an 8 mm microwave interferometer. Laser action occurs for strong mirror curvatures unstable even in an empty cavity, indicating that some modes include wall reflections. Suppression of these wall modes greatly reduces the observed range of stable mirror curvatures. Dissert. Abstr.

N71-19224* Lockheed Missiles and Space Co., Palo Alto, Calif.
STATE OF THE ART AND PROSPECTS OF THE DEVELOPMENT OF HOLOGRAPHY
A. L. Mikaelian 1970 14 p refs Transl. into ENGLISH from Radiotekhnika (USSR), v. 25, no. 10, 1970 p 3–12
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The properties of holograms were studied for developing practical applications of holography. The possibility of producing three-dimensional photographs and television are discussed with interference mapping. The application of holography methods considered include nondestructive testing of items of complex shape at high speed; automation of checking complicated microcircuits; and analysis of electromagnetic and acoustic fields. F.O.S.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-18155# Technische Hogeschool, Eindhoven (Netherlands).
THERMOTRANSPORT OF OXYGEN AND NITROGEN IN BETA-ZIRCONIUM, BETA-TITANIUM, NIOBIUM AND TANTALUM
Daniel Lodewijk Vogel (Ph.D. Thesis) 1969 164 p refs
(NP-18486) Avail: AEC Depository Libraries

Single-phase alloys of oxygen and nitrogen in metals of groups 4A and 5A were used. Their reliability was discussed based on computer calculations and the data presented. The heat of transport of oxygen in beta-zirconium was found to be 21.3 kcal/mole with a standard deviation of 2.9 kcal/mole, and that of nitrogen 25.1 kcal/mole with a standard deviation of 2.5 kcal/mole. The study of thermotransport of oxygen and nitrogen in titanium, niobium, and tantalum is complicated by evaporation processes. Oxygen and nitrogen in beta-titanium were found to have a positive heat of transport. Results gave a strong indication that the heat of transport of oxygen in alpha-titanium is negative. The heat of transport of oxygen, and probably also that of nitorgen, in niobium is very low. The heat of transport of oxygen in tantalum was found to be negative: an estimate yielded a value of approximately -10 kcal/mole. NSA

N71-18244# Iowa Univ., Iowa City. Dept. of Mechanical Engineering.
CYCLIC YIELD BEHAVIOR OF POLYCRYSTALLINE NIOBIUM
Satish K. Agrawal and Ralph I. Stephens Oct. 1970 31 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-714819; THEMIS-UI-26) Avail: NTIS CSCL 11/6

Previous investigations showed that the room temperature upper and lower yield point stress of b.c.c. iron and molybdenum can be completely removed by initially elastic cyclic stressing above the fatigue limit. The research described shows the upper and lower yield point stress in niobium can also be removed under these same conditions. The cyclic stress-strain curve of niobium was found to cyclically strain soften at small strain amplitudes and cyclically strain harden at larger strains. Under constant cyclic strain amplitudes in the inelastic region niobium cyclically strain hardens and quickly reaches a stable hysteresis loop. The described cyclic yield point behavior was explained in terms of localized cumulative multiplication of mobile dislocations. Author (GRA)

N71-18245# National Aerospace Lab., Amsterdam (Netherlands).
CRACK PROPAGATION IN ALUMINUM ALLOY SHEET MATERIALS UNDER FLIGHT SIMULATION LOADING Technical Report, Feb. 1967–Dec. 1968
J. Schijve, F. A. Jacobs, and P. J. Tromp Wright-Patterson AFB, Ohio AFFDL Sep. 1970 77 p refs
(Contract F61052-67-C-0076)
(AD-715331; NLR-TR-68117; AFFDL-TR-69-50) Avail: NTIS CSCL 11/6

A large number of flight-simulation tests were carried out on sheet specimens of 7075-T6 and 2024-T3 clad material. A gust load spectrum was adopted and a flight-by-flight loading was applied. The investigation is essentially concerned with macrocrack propagation although a few exploratory tests were conducted on the crack nucleation period. The major trends emerging from tests with a variety of loading programs are: (1) The omission of taxiing loads from the ground-to-air cycles did not affect the crack propagation. (2) The sequence of the gust cycles in a flight (random, programmed, reversed gust cycles) did not have a significant influence on the crack propagation. (3) Omission of gust cycles with small amplitudes systematically increased the crack propagation life. (4) The most predominant effect on the crack propagation was coming from the maximum gust amplitude included in the test. Increasing this amplitude gave a large increase of the crack propagation life. (5) Application in each flight of a single gust load only, namely the largest upward gust load, increased the crack propagation life three times. (6) Omission of the ground-to-air cycle increased the life 1.5-1.8 times. The discussion and the analysis of the results include such aspects as fractographic analysis, possible mechanisms for interaction effects between load cycles of different magnitudes and damage calculations. Author (GRA)

N71-18259# Case Western Reserve Univ., Cleveland, Ohio.
DISOLOCATION-SOLUTE ATOM INTERACTIONS IN ALLOYS Technical Progress Report
R. Gibala, M. G. Ulitchny, G. J. Kiems, A. K. Vasudevan, and A. A. Sagues 31 Oct. 1970 32 p refs
(Contract AT(11-1)-1676)
(COO-1676-13) Avail: NTIS

The anelastic behavior of Fe–Ni–C and Fe–Cr–Ni–C austenites at 25 to 400 C was investigated by torsional pendulum methods. A bound-pair carbon peak observed in these alloys is interpreted as a stress-induced carbon-vacancy reorientation process. The internal friction of Fe–Ni–C martensites was studied. Results of this study were not clear enough to allow establishment of the role of dislocations in the dissolution of eta-phase carbide precipitates. Work on dislocation-solute atom interactions in bcc metals by measurements of dislocation damping was continued. Research on hardening and softening in bcc refractory metals was mainly directed to Nb. Results show that interstitial hardening is associated with the high strength of bcc metals and is thermally activated. Results of anelasticity experiments are included which are the basis for models by alloy softening. NSA

N71-18277# Sandia Corp., Albuquerque, N.Mex.
SURVEY OF FACTORS WHICH INFLUENCE STRESS CORROSION CRACK INITIATION IN SEVERAL URANIUM BASE ALLOYS
L. L. Stephenson Oct. 1970 25 p refs Sponsored by AEC
(SC-DR-70-718) Avail: NTIS

The effects of a number of metallurgical and electrochemical variables on the initiation phase of stress corrosion cracking in Mulberry (U-7 1/2% Nb -2.5% Zr), U-4 1/4% Nb, U-6 1/2% Nb, and U-8 1/2% Nb alloys were determined. A potentiostat was used to establish the passivation behavior of Mulberry in several different solutions. Bend specimens, immersed in aqueous solutions and held at constant potentials, were used to investigate the stress corrosion crack initiation characteristics of the various alloys. The effect of potential on the mode of crack growth in Mulberry in dilute KCl solutions was determined. Author (NSA)

N71-18309# Idaho Nuclear Corp., Idaho Falls.
EFFECT OF FAST NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF HAFNIUM
G. E. Korth, C. R. Brinkman, and J. M. Beeston Oct. 1970 18 p refs
(Contract AT(10-1)-1230)
(IN-1440) Avail: NTIS

Property changes of hafnium specimens irradiated to fast neutron exposures of 0.6 to 1.4 × 10 to the 21st power n/sq cm (E > 1 MeV) at 110 C have been measured utilizing tensile tests, immersion density, hardness, fractography, metallography, and transmission electron microscopy. The ultimate and yield strength increased significantly with increased exposure, reduction in area decreased slightly, but the total elongation remained unchanged as compared to unirradiated control specimens. Ultimate failure occurred by shear in all specimens. Comparison between the microstructure of unirradiated and irradiated hafnium in both the deformed and undeformed state is presented. Author (NSA)

N71-18310# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
OBSERVATIONS ON THE NUCLEATION AND GROWTH OF VOIDS IN NICKEL
J. L. Brimhall, H. E. Kissinger, and B. Mastel 18 May 1970 2 p refs Presented at the 28th Meeting on Electron Microscopy Soc. of Am., Houston, Tex. Sponsored in part by AEC
(BNWL-SA-3300; CONF-701003-6) Avail: NTIS

Radiation effects on the microstructure of high purity Ni are described. Foils of Ni were exposed to fast neutrons at 300, 400, and 450 C. An explanation of void nucleation is included along with micrographs and data on density and size of voids. NSA

N71-18311# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
UNIAXIAL AND BIAXIAL CREEP-RUPTURE OF TYPE 316 STAINLESS STEEL AFTER FAST REACTOR IRRADIATION
A. J. Lovell and R. W. Barker Sep. 1970 30 p refs Presented at the Symp. on Effects of Radiation on Structural Mater., Niagara Falls, Ontario, Can., 29 Jun. –2 Jul. 1970 Prepared in cooperation with WADCO Corp.
(Contract AT(45-1)-1830)
(BNWL-SA-3295; WHAN-FR-19, CONF-700630-1) Avail: NTIS

The results from both uniaxial and biaxial tests at 538 C showed significant losses in rupture life relative to unirradiated specimens when compared on the basis of initial true stress. Rupture life was reduced by factors down to 1/20 for uniaxial and by factors down to 1/40 for biaxial tests. The substantial loss in rupture life at 538 C was primarily a result of high creep rates, and the contribution from ductility loss was relatively small. Uniaxial test results at 593 C showed reductions in rupture life of a factor of 1/5 at high stresses and only small reductions at low stresses. The rupture life for both uniaxial and biaxial tests at 649 C showed only a factor of 1/2 decrease after irradiation. The decrease became more substantial again at 760 C with a factor of 1/10 to 1/7 reduction in life. The underlying cause of the low ductility at these higher temperatures is associated with helium embrittlement and defect structure. Author (NSA)

N71-18312# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE MECHANISM OF ACTION OF CERTAIN VOLATILE CORROSION INHIBITORS
J. Mindowicz 25 Aug. 1970 19 p refs Transl. into ENGLISH from Proceedings of Intern. Congr. on Metal Corrosion, 3d (Moscow), v. 2, 1968 p 163–171
(AD-714803; FTD-MT-24-165-70) Avail: NTIS CSCL 7/4

The adsorption microcell method was used for determining the electrochemical properties of the following vapor-phase inhibitors: mono and dicyclohexylamine benzoates, dibenzylamine benzoate, dicyclohexylamine chromate and nitrite, dibenzylamine nitrite, and dicyclohexylamine carbonate. The inhibiting effect of these inhibitors was evaluated with mild steel samples pretreated by conventional methods and fixed in a specially designed and constructed corrosion chamber. Corrosion tests were under standard conditions. A given potential shift due to the adsorption of the inhibitor in the microcell was plotted vs potential stabilization time for all investigated inhibitors. Author (GRA)

N71-18390# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
TRANSPORT PROPERTIES OF Gd-Th, Gd-Mg AND Y-Th ALLOYS
Donald Williams Mellon (Ph.D. Thesis) Oct. 1970 110 p refs
(Contract W-7405-eng-82)
(IS-T-379) Avail: NTIS

The electrical resistivity, thermal conductivity, and thermoelectric power were measured as functions of temperature from 5 to 300 K to look for a periodic magnetic structure in Gd alloyed with Th and Mg. Eight samples were measured. The electrical resistivity of a Gd sub 0.88 Mg sub 0.12 sample indicates the existence of a periodic magnetic ordering, whereas the other alloys which were more Gd-rich order ferromagnetically. This result is interpreted as further evidence that large nesting areas are features of the Fermi surface which are necessary for the existence of a periodic magnetic state. The Gortner–Nordheim relation and Ziman's R parameter are used to discuss rigid-band model behavior for these alloys. Also, large magnon-drag peaks in the thermoelectric power of the Gd–Th alloys, which are not observed in either gadolinium or any of the other alloys, are explained by considering only the d-nature of the conduction band of the alloys. Author (NSA)

N71-18443*# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

INFLUENCE OF DEFECTS CREATED BY NEUTRON IRRADIATION AT 80 K ON THE ELASTIC MODULI AND INTERNAL FRICTION OF MAGNESIUM [INFLUENCE DES DEFAUTS CREES PAR UNE IRRADIATION NEUTRONIQUE A 80K SUR LES MODULES ELASTIQUES ET LE FROTTEMENT INTERIEUR DU MAGNESIUM]

Jacques Hillairet, Emmanuel Bonjour, and Jean-Paul Poirier 1970 26 p refs In FRENCH Presented at Conf. on Anelastic Effects Due to Defects and Phase Transformations in Solids, Lausanne, Switz., 24–26 Jun. 1970

(CEA-CONF-1621; CONF-700624-1) Avail: AEC Depository Libraries

Defects caused by irradiation at 80 K in two grades of magnesium (99.95% and 99.997%), after annealing at 450 C, lead to an appreciable reduction of the internal friction and elastic moduli. For high neutron doses, the decrease is about 4% for the Young's modulus and reaches 7% for the shear modulus. The magnitude of the modulus variation observed in magnesium cannot be explained either by a possible anelastic effect or by conventional models of the elastic effect in volume. It may be due to a large local change in the elastic constants, or to apparent modulus effects. The annealing of radioinduced defects is studied in the temperature ranges associated with stage 3 (90 to 170K) and with a recovery above room temperature. Author (NSA)

N71-18479# Bureau of Mines, Albany, Oreg. Metallurgical Research Center.

PROPERTIES OF CAST COLUMBIUM CARBIDE-CARBON ALLOYS

Gene Asai, D. L. Paulson, and Hal J. Kelly Feb. 1971 74 p refs

(BM-RI-7479) Avail: Issuing Activity

Properties obtained for columbium carbide-carbon castings ranging in carbon content from 12 to 17 weight-percent were compared with those of hot-pressed composites of similar composition. The properties were oxidation resistance in static air between 500 and 700 C, linear thermal expansion between 20 and 2,400 C, electrical resistivity between 20 and 1,500 C, microhardness between 20 and 1,500 C, and modulus of rupture between 1,300 and 1,800 C. CbC-C castings differed markedly from hot-pressed material with respect to microstructure, electrical resistivity, and modulus of rupture, but behaved quite similarly with respect to oxidation resistance, thermal expansion, and hot hardness. In oxidation resistance, thermal expansion, and hot hardness both materials were independent of carbon content. Both castings and hot-pressed composites oxidize rapidly in air above 600 C, have thermal expansion coefficients very similar to columbium metal, and the logarithm of the hardness decreases linearly with increasing temperature. The modulus of rupture of castings was 1-1/2 to 2 times that of hot-pressed composites. Both materials displayed bend ductility above 1,800 C. Author

N71-18513# Bureau of Mines, Reno, Nev. Metallurgy Research Center.

ELECTROTRANSPORT OF IMPURITIES IN RARE-EARTH METALS, USING A PULSED CURRENT

J. D. Marchant, E. S. Shedd, T. A. Henrie, and M. M. Wong Feb. 1971 16 p refs

(BM-RI-7480) Avail: Issuing Authority

Solid-state electrotransport of impurities in cerium, lanthanum, and praseodymium, using a pulsed current, was investigated. The results were compared with those of using a steady current. Impurities that showed appreciable movement with the pulsed current, but not with the steady current, were as follows: molybdenum and oxygen in cerium, aluminum, iron, and molybdenum in lanthanum. The use of a pulsed current enhances the practical application of solid-state electrotransport to remove a wider variety of impurities from the host metals. Author

N71-18515*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MODIFICATION OF HIGH-TEMPERATURE COBALT-TUNGSTEN ALLOYS FOR IMPROVED STABILITY

Robert L. Dreshfield, John C. Freche, and Gary D. Sandrock Washington Feb. 1971 25 p refs

(NASA-TN-D-6147; E-5944) Avail: NTIS CSCL 11F

A cobalt-base alloy based on the cobalt-tungsten system, with high strength in the 2000 to 2125 F (1094 to 1163 C) range was identified. It has an average stress rupture life over 2000 hours at 2125 F (1163 C) at a stress of 4000 psi (28 MN/sq m) in helium. A method of alloy design to achieve microstructural stability based on a linear relationship between the amount of Co3W, the embrittling phase in this alloy system, and the average electron vacancy concentration N (sub V) was demonstrated. Author

N71-18521# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.

DOUBLE DIFFRACTION BETWEEN BRAGG REFLECTIONS AND PLANES OF DIFFUSE INTENSITY OBSERVED WITH HIGH ENERGY ELECTRON DIFFRACTION

Stephen L. Sass Nov. 1970 11 p refs

(Contract N00014-67-A-0077-0012)

(AD-715373; MSC-1412; TR-2) Avail: NTIS CSCL 11/6

The production of spurious lines of intensity in high energy electron diffraction patterns by double diffraction between a strong Bragg reflection and a plane of diffuse intensity was demonstrated in a Ti-Nb alloy containing the omega phase. The conclusion that (111) planes of diffuse intensity passing through the reciprocal space origin are absent was shown to be consistent with the presence of <111> rows of omega particles suspended in a b.c.c. matrix. Author (GRA)

N71-18523# Army Materials and Mechanics Research Center, Watertown, Mass.

MECHANICAL PROPERTIES OF Ti-6-Al-6V-2-Sn-3Zr-1Fe-1Cu-0.1C ALLOY

Stanley M. Wolf and Perry M. Smoot Sep. 1970 24 p refs

(AD-715353; AMMRC-TR-70-25) Avail: NTIS CSCL 11/6

Mechanical properties and microstructures were determined after various heat treatments for three section thicknesses (1-1/8 inch, 5/8 inch, and 3/8 inch) of the Ti-6Al-6V-2Sn-3Zr-1Cu-1Fe-0.1C alloy. The heat treatments producing the best mechanical properties according to military specification MIL-T-46038 consisted of solutionizing for one hour in the temperature range of 1450 F and 1550 F followed by aging for four to eight hours in the temperature range of 1000 F and 1100 F. In general, yield strengths between 200 and 220 ksi and values exceeding 5% elongation, 12% reduction of area, and 5 foot-pounds impact energy at –40 F were obtained with the above heat treatments. Higher strength and lower ductility and impact energy levels were achieved with the higher solution temperature and lower aging temperature of the above ranges. Author (GRA)

N71-18540# Fraunhofer Institut, Freiburg (West Germany).

MAGNETIC FIELD EFFECT ON THE HIGH PRESSURE PHASE DIAGRAMS OF ARMCO IRON AND NORMALIZED CONSTRUCTION STEEL [DER EINFLUSS EINES MAGNETFELDES AUF DIE HOCHDRUCKPHASENDIAGRAMME VON ARMCO-EISEN UND NORMIERTEM BAUSTAHL]

D. R. Curran and U. Hornemann Aug. 1970 24 p refs In GERMAN

(Rept-6/70) Avail: NTIS

Shock wave experiments are described during which the influence of a magnetic field on the high pressure phase diagrams of Armco iron and non-alloyed construction steel is measured. The

magnetization creates a 10 kbar lowering of the transition pressure from the ferromagnetic to the paramagnetic phase, and from the ferromagnetic to the antiferromagnetic phase, of both materials. ESRO

N71-18552# Northrop Corp., Hawthorne, Calif.
EMBRITTLEMENT BY LIQUID METALS Final Report, 9 Mar.–8 Oct. 1970
M. H. Kamdar Nov. 1970 6 p refs
(Contract DAHC04-70-C-0028)
(AD-715741; NCL-70-75-R; AROD-9218-1-MC) Avail: NTIS CSCL 11/6

The report gives a summary of the investigations performed under the general title, Embrittlement by Liquid Metals. During the period of the report, an earlier investigation of the effects of second phases on the susceptibility of zinc-cadmium alloys to embrittlement by liquid mercury at ambient temperature was continued. The investigation with zinc-cadmium alloys was intended to elucidate the roll of phase in inhibiting the embrittlement of the matrix phase (zinc) in mercury. In other studies, polycrystalline aluminum 2.5 w/o-zinc 5.3 w/ O-magnesium alloys containing varying thicknesses (0.04 to 0.35 microns) of denuded zones at the grain boundary were tested in tension to fracture in liquid mercury at 25C. In addition, studies were undertaken to investigate the roll of the chemical nature of the liquid metal or liquid metal solutions in determining the occurrence and the severity of liquid metal embrittlement in a given embrittlement couple. These studies revealed that the severity of liquid metal embrittlement is related to the electronegativities of the participating solid and liquid metal. Author (GRA)

N71-18584# Ghent Univ. (Belgium). Materials Resistance Lab.
INFLUENCE OF SOME PLASTICS COATINGS AND DIFFERENT ENVIRONMENT MEDIA ON THE FATIGUE STRENGTH OF STEEL PLATES
Robert Vancrombrugge and Piet Boone Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Oct. 1970 39 p refs Sponsored by IRSIA
(CRIF-MT-64) Avail: NTIS

The influence of plastic coatings, such as epoxides (Araldite), synthetic elastomers (Thiokol) and neutral ball-bearing grease, and media, such as air, lubricating oil, light fuel, and normalized sea water, on the fatigue resistance of notched and unnotched medium strength steel plates was studied. It was concluded that; highest resistance was obtained for specimen machined steel greased with neutral grease; lowest resistance was obtained for specimen machined steel, cleaned and immersed in sea water but th is result is due to corrosion effects; cleaning of the specimen decreased the resistance as compared to greasing; plastic coatings still decreased the resistance as compared to cleaning when tested in air; media such as fuel and lubricating oil still decreased the resistance; when corrosion effects were present plastic coatings were favorable. Author (ESRO)

N71-18585# Ghent Univ. (Belgium). Materials Resistance Lab.
MICRO-HOT TEARING IN THE HEAT AFFECTED ZONE OF HIGH STRENGTH STEELS
Andre-Gustaaf Vinckier Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Oct. 1970 29 p refs Sponsored by IRSIA
(CRIF-MT-63) Avail: NTIS

Evidence is presented that in steels which were found to be highly susceptible to form cracks in the heat affected zone of low or high heat input welds or performed very badly in welded wide plate tensile tests, hot tearing on a submicroscopic scale had occurred on the prior austenite grain boundaries in the immediate vicinity of the fusion face. This type of hot tearing, which is caused by a peculiar wetting of the grain faces by molten sulfide films, is difficult to recognize under the optical microscope but can be detected under the electron microscope on heat affected zone fracture surfaces. This phenomenon can be reproduced in small specimens when they are subjected to a weld simulation cycle, the peak temperature of which is set about 50 C below the melting point of the steel. Although each micro-hot tear is by itself extremely small, they are usually manifold and scattered next to each other forming networks over many adjacent prior austenite grain boundaries. They can occur on such a large scale that the effective cross section of a load carrying weld might be reduced. It is believed that further crack extension occurs from these defects, such as hot cracks visible under the optical microscope, cold cracking, lamellar tearing or even continued extension of brittle failures if high stresses are imposed or some plastic deformation is demanded during cooling or loading. Author (ESRO)

N71-18597# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
STANDARD REFERENCE MATERIALS: ANALYSIS OF INTERLABORATORY MEASUREMENTS ON THE VAPOR PRESSURES OF CADMIUM AND SILVER (CERTIFICATION OF STANDARD REFERENCE MATERIALS 746 AND 748)
Robert C. Paule and John Mandel Jan. 1971 30 p refs
(NBS-SP-260-21) Avail: SOD $0.35 Catalog No. C 13.10:260-21

Detailed statistical analyses were made of results obtained from a series of interlaboratory measurements on the vapor pressures of cadmium and silver. Standard Reference Materials 746 (cadmium) and 748 (silver), which were used for the measurements, have been certified over the pressure ranges 7.6 ntorr to 76 mtorr and 760 ptorr to 760 mtorr. The temperature ranges corresponding to these pressures are 350 to 594 K for cadmium and 800 to 1600 K for silver. The heats of sublimation at 298 K and the associated two standard error limits for cadmium and silver are 26,660 + or − 150 cal/mol and 68,010 + or − 300 cal/mol, respectively. Estimates of uncertainty were calculated for the certified temperature-pressure values as well as for the uncertainties expected from a typical single laboratory's measurements. The statistical analysis was also made for both the second and third law methods, and for the within- and between-laboratory components of error. The uncertainty limits are observed as functions of both the heat of sublimation and the temperature. Author

N71-18601# Naval Research Lab., Washington, D.C. Transformations and Kinetics Branch.
REPORT OF NRL PROGRESS
Jan. 1971 31 p refs
Avail: NTIS

X-ray powder diffraction line profile studies were made from hexagonal close-packed titanium-aluminum alloys. A Fourier analysis of the profiles was used to separate the total broadening into that caused by domain size, root-mean-square (rms) microstrains, and stacking faults. The stacking-fault probability and the rms microstrains of the titanium-aluminum alloys decrease with increasing aluminum content, whereas the domain size remains relatively constant. This change in stacking-fault probability is used to explain the corresponding changes in dislocation structures. Author

N71-18758# Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL-PROPERTY DATA 7175 ALUMINUM: T736 FORGING
Sep. 1970 10 p
(Contract F33615-69-C-1115)
(AD-715878) Avail: NTIS CSCL 11/6

Aluminum alloy 7175 is a new Premium Strength Die Forging. This development is intended to provide relatively high strength/weight ratios for aerospace applications. The guaranteed

minimum longitudinal yield strength for the -T736 temper is approximately 17 percent above the current minimum requirements of specifications covering 7075 alloy die forgings in the -T73 temper. Although the development emphasis was placed on high longitudinal strength, the transverse ductility is also well above that of most conventional 7075 die forgings. Tests on a limited number of forgings in the -T736 temper indicate that the stress-corrosion cracking threshold in the short transverse direction should be at least 35 ksi. Currently, the product is limited to closed die airframe-type forgings. Author (GRA)

N71-18769# Pennsylvania Univ., Philadelphia. School of Chemical Engineering.

FUNDAMENTAL CORROSION STUDIES: HYDROGEN EMBRITTLEMENT

T. K. G. Namboodhiri and Leonard Nanis Dec. 1970 40 p refs
(Contract N00014-67-A-0216-0004)
(AD-715807; UPH2-TR-002) Avail: NTIS CSCL 11/6

The electrochemical permeation method was extended by analysis of the decay transient following steady state permeation. From the amount of extracted hydrogen compared with the amount predicted by the permeation model, it is postulated that hydrogen diffusivity in Armco iron is concentration dependent. Permeation studies of cold-rolled Armco iron indicate (a) diffusivity D(21C) decreases from, 5 x 10 to the −5th to 0.5 x 10 to the −5th sq cm/sec. in going from annealed to 2% reduced samples; (b) deformation results in increasing absorption of hydrogen from 1 x 10 to the −8th to 300 x 10 to the −8th mole H/c.c. of Fe., in going from zero to 17.6% reduction in thickness; (c) additional cold work produces little further change in hydrogen absorbed or in apparent diffusivity. Author (GRA)

N71-18779# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.

MEASUREMENT AND INTERPRETATION OF ISOTHERMAL-MARTENSITIC KINETICS

V. Raghavan and Morris Cohen Dec. 1970 55 p refs
(Contract N00014-67-A-0204-0027)
(AD-715791; TR-5) Avail: NTIS CSCL 11/6

A brief survey of experimental work on isothermal martensitic transformations is given. Recent results on quantitative metallography are presented. Models for the isothermal kinetics and the method of evaluating the autocatalytic factor as well as the activation free energy for nucleation are discussed. The linear dependence of the activation energy on the chemical free-energy change is found to extrapolate satisfactorily to the low M sub s temperatures exhibited by Fe-Ni alloys. The values obtained by substituting the above empirically-determined parameters into the Kaufman-Cohen nucleation equation indicate that the embryos in Fe-Ni alloys are more potent than those in Fe-Ni-Mn alloys, whereas the interfacial energies are quite similar. Author (GRA)

N71-18816*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A REVIEW OF NASA RESEARCH TO DETERMINE THE RESISTANCE OF MATERIALS TO CAVITATION DAMAGE IN LIQUID METAL ENVIRONMENTS

Stanley G. Young and John C. Freche [1970] 62 p refs Proposed for Presentation at the Intern. Conf. on Corrosion Fatigue, Storrs, Conn., 14 − 18 Jun. 1971
(NASA-TM-X-52956; E-6137) Avail: NTIS CSCL 11F

A long range program to investigate cavitation damage in liquid metal environments, conducted with a wide variety of materials, is reviewed. A magnetostrictive vibratory apparatus was used to determine the cavitation damage resistance of iron-base, nickel-base, and cobalt-base alloys in liquid sodium and mercury. The combined effects of temperature and pressure of the cavitating liquid on the degree of material damage were determined. The interrelationships between material properties and cavitation damage were investigated. Extensive metallurgical studies were made to delineate the nature of material damage. Author

N71-18826# North American Rockwell Corp., Los Angeles, Calif.

THE EARLY DETECTION OF FATIGUE DAMAGE Semiannual Report, 1 Jun. −30 Nov. 1970

J. F. Moore, S. Tsang, F. M. Coate, D. S. Weinstein, and S. Hoenig 30 Nov. 1970 46 p
(Contract F33615-68-C-1706; ARPA Order 1244)
(AD-715630; NA-70-640; SAR-3) Avail: NTIS CSCL 11/6

The report describes the continuing effort to develop nondestructive test methods capable of determining the extent of fatigue damage and providing a means of predicting the future safe life of aerospace materials and structures. During the report period, the fatigue process in 1100-O aluminum was studied by means of exoelectron emission and acoustic emission measurements. The exoelectron observations were by means of measuring the current produced by fatigue damage in air; the acoustic emission measurement was based on the number of acoustic events occurring in selected time intervals during fatigue. It appears that there is a trend indicative of a stress-independent relationship between the change of exoelectron emission current and the percentage of the spent fatigue life based on the current after a selected number of cycles. The intensity of acoustic emission was shown to increase or decrease by orders of magnitude during the fatigue life. The first significant change of acoustic emission was apparently correlatable to 8 to 20 percent of the specimen fatigue life. The continuing metallographic examination confirmed that surface slip striations appear very early in the fatigue process and appear to directly correlate with the exoelectron emission phenomenon. Author (GRA)

N71-18831# Battelle Memorial Inst., Columbus, Ohio.

MECHANICAL-PROPERTY DATA 6AI-4V TITANIUM DRAWN AND ANNEALED EXTRUSIONS

Sep. 1970 8 p
(Contract F33615-69-C-1115)
(AD-715880) Avail: NTIS CSCL 11/6

The alloy is one of the most widely used alloys of titanium. For this evaluation a thin T section extrusion was chosen to obtain properties for the material after the drawing process. Author (GRA)

N71-18832# Battelle Memorial Inst., Columbus, Ohio.

MECHANICAL PROPERTY DATA 38-6-44 TITANIUM ALLOY: AGED FORGING

Sep. 1970 9 p refs
(Contract F33615-69-C-1115)
(AD-715877) Avail: NTIS CSCL 11/6

Al-8 V-6 Cr-4 Mo-4 Zr is a new deep-hardening beta composition alloy. The large amount of beta stabilizing elements in this composition results in sluggish transformation characteristics which give deep hardening. The metallurgy of 38-6-44 alloy is similar to other beta alloys such that solution annealing retains the more ductile body-center-cubic beta phase at room temperature. The 6-inch by 6-inch billet used in this property survey was solution annealed at 15pp F for 15 minutes and air cooled, plus aging at 1050 F for four hours. Author (GRA)

N71-18854# Battelle Memorial Inst., Columbus, Ohio.

MECHANICAL-PROPERTY DATA: MP 35 N, WORK STRENGTHENED AND AGED BAR

Sep. 1970 9 p refs
(Contract F33615-69-C-1115)
(AD-715879) Avail: NTIS CSCL 11/6

MP35N is a new nickel-cobalt-chromium-molybdenum alloy. MP35N is hardened by work strengthening and aging to strength levels of 260 - 300 ksi. In addition to high strength and good ductility, the alloy is reported to have excellent resistance to corrosion and stress corrosion in salt water and other chloride solutions. Potential usage of this material is for fasteners, springs, marine drive shafts, cables, etc. MP35N is available as ingot, billet, bar stock, wire, and tubing. A fabricator of flat-rolled products will be licensed soon so that all product forms will be available. Author (GRA)

N71-18858*# National Bureau of Standards, Washington, D.C.
ELECTRODEPOSITION OF MAGNESIUM AND BERYLLIUM FROM ORGANIC BATHS
Abner Brenner and John L. Sligh [1971] 30 p refs
(NASA Order L-37566)
(NASA-CR-111850) Avail: NTIS CSCL 11F

Solutions that are feasible for electrodepositing magnesium were prepared from Grignard reagents with the addition of boranes in ether solutions. A typical bath consisted of methylmagnesium chloride, 3-molar, (dissolved in tetrahydrofuran) and 1-molar in triethylboron. The deposits were white, ductile, and contained at least 99 percent magnesium. A similar beryllium plating solution, prepared with beryllium dimethyl and decaborane, yielded dark grey, coherent deposits containing 85 to 90 percent beryllium. Author

N71-18864*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN EVALUATION OF THE MECHANICAL AND STRESS CORROSION PROPERTIES OF COLD WORKED A-286 ALLOY
J. W. Montano 12 Feb.1971 38 p refs
(NASA-TM-X-64569) Avail: NTIS CSCL 11F

The mechanical properties of cold worked, precipitation hardened, A-286 corrosion resistant bar stock are discussed. Test specimens manufactured from approximately 1.0 inch diameter bar stock were tested at temperatures from 75 F to −423 F. The test data indicated excellent tensile strength, ductility, and impact properties. Results of the alternate immersion stress corrosion tests on stressed and unstressed tensile specimens and transverse ring specimens indicated that the material is not susceptible to stress corrosion cracking when tested in a 3.5 percent NaCl solution for 180 days. Author

N71-18922# Brown Univ., Providence, R.I. Div. of Engineering.
PRECIPITATION AND DISLOCATIONS IN AN ALUMINUM-SILICON ALLOY
K. D. Prince and M. H. Richman Aug. 1970 140 p refs
(Contract AT(30-1)-2394)
(NYO-2394-40) Avail: NTIS

The precipitation of silicon from an aluminum 0.8 weight percent silicon alloy was studied as a function of aging time and temperature. All samples were solution treated at the eutectic temperature (577 C) and water quenched. The precipitation reaction was followed by microhardness testing and transmission electron microscopy. As a result of the hardness a definite strengthening peak was noticed; the orientation and morphology of the precipitated silicon particles were also defined. Author (NSA)

N71-18942# California Univ., La Jolla. Dept. of Physics.
MAGNETIZATION OF DILUTE Cu-Mn ALLOYS AT VERY LOW TEMPERATURES
E. C. Hirschkoff, O. G. Symko, and J. C. Wheatley [1970] 6 p refs
(Contract AT(04-3)-34)
(UCSD-34-P-143-33) Avail: NTIS

The magnetization of several very dilute Cu-Mn alloys was measured from 0.35 K to 0.012 K. The results can be explained primarily by impurity-impurity interactions. Author (NSA)

N71-19001 Utah Univ., Salt Lake City.
KINETIC STUDIES OF THE ELECTROLYTIC REDUCTION OF CARBON DIOXIDE ON VARIOUS METALS
Margaret Yi-Ping Yang Hong (Ph.D. Thesis) 1969 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-2026

The reduction of CO2 to HCOOH in neutral solutions on Au, Pb, Zn, Cd, and Sn electrodes was studied. Steady state polarization curves, current efficiency measurements for HCOOH production, pH effect, stirring effect and the effect of different electrode pre-treatments on polarization curves, and potential decay curves were used to determine possible reaction pathways. In neutral solutions the mechanism may be described by a reduction of CO2 in parallel with the H2 evolution reaction, and these two reactions are charge transfer controlled. The catalytic activities of various electrodes are parallel for both CO2 reduction and H2 evolution, and are found to have rates which decrease in the order Zn > Au > Sn > Pb > or = to Cd > (Hg). The relative catalytic activities of the electrodes are thought to be due mainly to the relative energy of adsorption of the reaction intermediates on the various electrode surfaces. Dissert Abstr.

N71-19002 Lehigh Univ., Bethlehem, Pa.
ELECTRICAL CONDUCTIVITY AND ELASTIC MODULI OF PRESSURE-SINTERED LITHIUM SUBSTITUTED NICKEL OXIDE
Michael Richard Notis (Ph.D. Thesis) 1969 232 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 70-1735

Polycrystalline nickel oxide and lithium substituted-nickel oxide alloys ranging from 0.12 to 8.23 atomic percent lithium were prepared by vacuum pressure sintering. Changes in particle texture and shape, increased relative density, larger final grain size and a shifting fracture mode were observed with increased lithium content. This sintering behavior was interpreted in terms of enhanced oxygen diffusion caused by either a decrease in the chemisorptive surface properties or by an increase in the mobility of a coupled anion vacancy-electron hole complex. Pure nickel oxide was found to tend very close to stoichiometric proportions, deviations from stoichiometry being predominantly caused by the impurity-affected surface properties of the material. Analysis also indicated the absence of any detectable metallic nickel and showed no detectable lithium loss during pressure sintering. The discrepancy between these findings and those previously reported in the literature indicates previous difficulty in the careful preparation and characterization of these materials. Dissert. Abstr.

N71-19003 Denver Univ., Colo.
SOLUTE INTERACTIONS IN NIOBIUM-ZIRCONIUM-NITROGEN ALLOYS
Don Raymond Mosher (Ph.D. Thesis) 1969 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-1919

The Snoek effect and related mechanical relaxations offer a potent means of studying the behavior of interstitial atoms in body-centered cubic metals. Low-frequency measurements of internal friction were employed to deduce the nature of substutional-interstitial solute interactions in niobium alloyed with small amounts of zirconium and nitrogen. Relaxations associated with two solute interaction mechanisms were identified on the basis of the response of their damping peaks to changes in alloy composition. One relaxation accompanies the stress-induced rearrangement of single nitrogen atoms among the interstices

coordinating isolated zirconium atoms; the second is the result of a similar process relative to zirconium pairs. Interstitial mobilities during these relaxations were deduced from the temperature dependence of their respective relaxation times. Dissert. Abstr.

N71-19004 Stanford Univ., Calif.
THE DIFFUSION OF HYDROGEN IN SOME LIQUID METALS
Eduardo Milan Sacris (Ph.D. Thesis) 1969 240 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 70-1596

The absorption and diffusion of hydrogen in liquid nickel, copper, silver and tin were studied by the gas-liquid metal diffusion cell technique. Two variations of this method were used: steady state and unsteady state. The diffusion cell was formed by immersing an impervious alumina tube containing hydrogen at one atmosphere in a both of liquid metal. In either variation, the rate of absorption of the gas in the cell was determined. Appropriate solutions of Fick's first and second laws were used to examine the data and calculate diffusion coefficients. The rate of absorption of hydrogen in stagnant pure liquid nickel, copper and silver has been found to be diffusion controlled. The results show that the chemical diffusion coefficient D, of hydrogen in liquid pure nickel, copper and silver (in the range of 1478 to 1600 C for Ni, 1103 to 1433 C for Cu and 985 to 1208 C for Ag) can be represented at a 90% confidence level. Dissert. Abstr.

N71-19005# California Univ., Livermore. Lawrence Radiation Lab.
OBSERVATIONS OF TRANSFORMATION TEMPERATURES, MICROSTRUCTURE, HARDNESS, AND DIMENSIONAL ANISOTROPY ON THERMAL CYCLING OF A 300-GRADE MARAGING STEEL
Alfred Goldberg and Earl G. Snell, Jr. 6 Feb. 1970 59 p refs Presented at the 2d Inter-American Conf. on Mater. Technol., Mexico City, 24–27 Aug. 1970 Submitted for publication Sponsored by AEC
(UCRL-72099; CONF-700812-2) Avail: NTIS

The effects of heating rate, maximum temperature reached, and repeated thermal cycling on (1) transformation temperatures, (2) microstructure, (3) microsegregation, (4) retained austenite, and (5) degradation in hardness in a 300-grade maraging steel are described. Heating rates ranged from 0.002 to 700 C/sec. Transformation temperatures were obtained by dilatometry. The degradation in hardness under simulated welding conditions was examined. Permanent shape changes were obtained as a result of anisotropic transformation strains. The anisotropic strains are shown to be related to the direction of deformation used in the reduction of the steel ingot and to originate in the residual ingot segregation. Author (NSA)

N71-19011*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF HYDROGEN ON TENSILE PROPERTIES OF PALLADIUM-HYDROGEN SYSTEM
Robert J. Smith and Duman A. Otterson Washington Mar. 1971 13 p refs
(NASA-TN-D-6211; E-5922) Avail: NTIS CSCL 11F

Tensile properties of both annealed and as-received palladium wire were measured as functions of hydrogen content. Electrolysis at room temperature was the method used for hydrogen absorption. The yield stress, ultimate tensile stress, and elongation at maximum stress were determined and showed abrupt changes with respect to hydrogen content near the boundaries of the phase diagram. The dependence of the tensile properties on hydrogen content within a single phase region was interpreted in terms of electronic structure and work hardening. Auxiliary experiments were performed to substantiate that the formation of the beta-phase by the electrolytic absorption of hydrogen produced work hardening. Author

N71-19012# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
APPLICATION OF ELECTRON MICROSCOPY TO THE STUDY OF SURFACE TOPOGRAPHY AND SUBSURFACE MICROSTRUCTURE IN WEAR
G. T. Newman, O. D. Smith, D. K. Matthes, and C. R. Brooks Sep. 1970 25 p
(Contract N00014-68-A-0144)
(AD-715435; ME-70-T57-11) Avail: NTIS CSCL 11/6

The usefullness of utilizing electron microscopy in wear studies is illustrated by observations of the surface topography and subsurface microstructure of nickel-on-nickel specimens tested in dynamic wear in a nitrogen atmosphere. The nickel surfaces have a smeared and layered appearance. The subsurface microstructure has been observed as a function of depth below the wear surface; the structure is quite varied. Regions of extremely high dislocation density, characteristic of a high degree of plastic deformation, are seen, and regions of extremely fine grains (less than 0.0001 cm) are observed, showing that locally recrystallization has occurred due to a rather high temperature being attained. The substructure alterations extend down to 0.01 cm below the surface. It is clear that electron microscopic observations are indispensable in any detailed wear study. Author (GRA)

N71-19013*# Translation Consultants, Ltd., Arlington, Va.
STUDY OF THE BEHAVIOR OF BISMUTH SULFIDE, ANTIMONY SULFIDE AND ANTIMONY SELENIDE UNDER SUBLIMATION IN A VACUUM [IZUCHENIYE POVEDENIYA SULFIDOV VISMUTA I SURMY I SELENDIA SURMY PRI VOZGONKE V VAKUUME]
G. G. Gospodinov et al Washington NASA Mar. 1971 7 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Khim. (Moscow), v. 22, no. 2, 1967 p 54–57
(Contract NASw-2038)
(NASA-TT-F-13461) Avail: NTIS CSCL 11F

The sublimation of bismuth sulfide, antimony sulfide, and antimony selenide in a vacuum is studied. X-rays are used to analyze residues and condensates. Results show that these compounds do not change their compositions during sublimation. Author

N71-19014*# Translation Consultants, Ltd., Arlington, Va.
EFFECT OF CHROMALUMINIZATION ON THE FATIGUE STRENGTH AT 700 C OF AN INCONEL 713 ALLOY [INFLUENCE D'UN TRAITEMENT DE CHROMALUMINISATION SUR LA RESISTANCE A LA FATIGUE A 700 C D'UN ALLIAGE INCONEL 713]
G. Vidal et al Washington NASA Mar. 1971 8 p refs Transl. into ENGLISH from Rech. Aerospatiale (Paris), no. 3, 1970 p 177–179
(Contract NASw-2038)
(NASA-TT-F-13484) Avail: NTIS CSCL 11F

Inconel 713 alloy is tested for fatigue strength after chromaluminization treatment for protection against oxidation or corrosion. It is found that at a temperature of 700 C the chromaluminization treatment increases fatigue strength very slightly. Author

N71-19015# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.
ELECTROLYTIC PREPARATION OF VANADIUM FROM V2C-TYPE CARBIDE
K. P. V. Lei and T. A. Sullivan Washington Mar. 1971 20 p refs
(BM-RI-7484) Avail: Issuing Activity

An electrochemical process was developed for the preparation of vandium from vanadium carbide. Commercially available vanadium carbide was used as the starting material. Vanadium was obtained by electrolysis of the V2C in a BaCl2-KCl-NaCl-VC:2 electrolyte at 670 C using a helium atmosphere, molten-salt electrolytic cell.

Vanadium products were recovered with purities as high as 99.6 percent. Current efficiencies of 87 percent and vanadium recoveries of 84 percent were attained. The cathode products were amendable to electrorefining to high purity vanadium of 99.96-percent purity. Author

N71-19016# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

TUNGSTEN AND DISPERSION STRENGTHENED TUNGSTEN MADE BY FREEZE DRYING

M. J. Ferrante, R.R. Lowery, and G. B. Robidart Washington Mar. 1971 36 p refs

(BM-RI-7485) Avail: Issuing Activity

The applicability of the freeze drying technique is investigated for preparation of dispersion strengthened tungsten powders suitable for conversion by the powder metallurgy into materials which might have improved high temperature strength. Extruded rods from compacts of tungsten-5 vol pct thoria had, at 1,650 C, a tensile strength of 30,300 psi and a 10-hour stress-rupture strength of 12,700 psi. Only those tungsten-thoria dispersions containing a stoichiometric deficiency of oxygen yielded a significant strengthening effect. These tensile strengths were only slightly higher than strengths of elemental tungsten made from commercial powder having a particle size of 2.4 microns. Sheet made from this commercial tungsten had a slightly higher tensile strength than tungsten made by freeze drying, but the freeze dried tungsten sheet had a lower recrystallization temperature, a lower ductile-to-brittle transition temperature, and a higher purity. Author

N71-19027*# Techtran Corp., Glen Burnie, Md.

IMPROVEMENTS IN THE MICROPROBE ANALYSIS OF DIFFUSION LAYERS. APPLICATION TO AN INCONEL 713 CHROMALUMINIZED SAMPLE [PERFECTIONNEMENTS AUX METHODES D'ANALYSE PAR MICROSONDE DES COUCHES DE DIFFUSION. CAS DE L'INCONEL 713 CHROMALUMINISE]

Jacques Descamp et al Washington NASA Feb. 1971 22 p refs Transl. into ENGLISH from Rech. Aerospatiale (Paris), no. 2, Mar.–Apr. 1970 p 103–112

(Contract NASw-2037)

(NASA-TT-F-13497) Avail: NTIS CSCL 11F

The use of line scanning and two-dimensional scanning methods with a microprobe to analyze the surface layers of alloys which are deposited to protect the base metal is discussed. Examples of this analysis as applied to an Inconel 713 turbine blade protected by chromaluminization are given. Author

N71-19030# Bureau of Mines, Rolla, Md. Metallurgy Research Center.

EFFECTS OF MAGNESIUM ON THE MICROSTRUCTURE, HARDNESS, AND TENSILE PROPERTIES OF ZINC ALLOYS CONTAINING 25 TO 40 PERCENT ALUMINUM

L. A. Neumeier and J. S. Risbeck Washington Mar. 1971 38 p refs

(BM-RI-7491) Avail: Issuing Activity

The properties of zinc alloys containing 25 to 40 wt pct Al and 0 to 0.7 pct Mg were studied. Microstructures, hardness, and tensile properties were evaluated for material as extruded at 285 C, solution treated at 300 to 400 C, and subsequently aged at 100 to 200 C. The alloys without magnesium are characterized by low hardness and strength with high tensile elongation and reduction in area. It was verified that magnesium effectively retards the Zn-Al eutectoid transformation below 275 C and markedly increases hardness and strength with decreases in ductility. Solution treating at 350 C results in large grain sizes and gross embrittlement. Subsequent aging of the Zn-Al-Mg alloys at 200 C restores ductility substantially and stabilizes the structures, but strengths are considerably reduced. There is usually little advantage in overall tensile properties from increasing magnesium above 0.1 pct. Author

N71-19088# National Science Foundation, Washington. Special Foreign Currency Science Information Program.

STUDY OF DIFFUSION OF MANGANESE IN RELATION TO IMPURITIES IN TERNARY ALLOYS OF Ni-Mn-THIRD ELEMENT [ISSLEDOVANIE DIFFUZII MARGANTSA V ZAVISIMOSTI OT PRIMESEI V TROINYKH SPLAVAKH NIKEL-MARGANETS-TRETII ELEMENT]

S. D. Gertsriken et al 1970 11 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, Inst. Metallofiz. Sb. Nauchnykh. Rabot (Kiev), no. 5, 1954 p 71–77 Prepared in cooperation with NBS

(TT-70-57059; DMDC-2945) Avail: NTIS CSCL 11F

The effect of various impurities (Cu, Al, V, Mo, Ti) on the rate of diffusion of manganese in nickel-manganese alloys is studied over a temperature range of 850 to 1050 C. GRA

N71-19089# National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

INFLUENCE OF ORDERING ON DIFFUSION OF Cd IN Mg Cd3 ALLOY [VLIYANIE UPORYADOCHENIYA NA DIFFUZIYU KADMIYA V SPLAVE MgCd3]

W. Chomka 1970 13 p refs Transl. into ENGLISH from Acta Phys. Polon. (Warsaw), no. 24, 1963 p 669–674 Prepared in cooperation with NBS

(TT-70-5705; DMDC-2913) Avail: NTIS CSCL 11F

The diffusion of cadmium in MgCd3 alloy was studied by using the radioactive isotope Cd115. The following temperature dependence of the diffusion coefficient for the ordered and disordered state was found: D sub O = .000112 exp (−12400/RT); D sub dis = 0.074 exp (−16700/RT). Author (GRA)

N71-19096# National Science Foundation, Washington, D.C.

VOLUME AND GRAIN BOUNDARY DIFFUSION IN IRON [SAMODIFFUZIYA ZHELEZA V OBEME I PO GRANITSAM ZERNA]

S. Z. Bokshtein 1970 31 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 2, 1957 p 2–10 Prepared in cooperation with NBS

(TT-70-57048; DMDC-2893) Avail: NTIS CSCL 11F

Autoradiography was used to study grain boundary and volume self diffusion in alpha and gamma-iron at 800, 1000, 1100, and 1200C. Diffusion coefficients are calculated for both cases in qualitative study. Author (GRA)

N71-19098# National Science Foundation, Washington, D.C.

EFFECT OF SMALL AMOUNTS OF IMPURITIES (ANTIMONY AND BERYLLIUM) ON THE RATE OF DIFFUSION OF ZINC IN POLYCRYSTALLINE BRASS [O VLIYANII MALYKH PRIMESEI SURMY I BERILLIYA NA SKOROST DIFFUZII TSINKAV POLIKRISTALLICHESKOI LATONI]

S. A. Memnonov 1970 43 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Ural. Fil., Inst., Fiz. Met., Tr. (Moscow), no. 11, 1950 p 90–103

(TT-70-57080; DMDC-5405) Avail: NTIS CSCL 11F

The effect of grain boundry segregation of antimony and beryllium in brass on the rate of self diffusion of zinc is studied. Grain size, temperature, and composition are varied and the effects are measured. GRA

N71-19099# National Science Foundation, Washington, D.C.

STUDY OF KINETICS OF CHANGE IN PROPERTIES OF METALS AND ALLOYS ON HEATING BY THE METHOD OF

ELASTIC VIBRATIONS [IZUCHENIE METODOM UPRUGIKH KOLEBANII KINETIKI IZMENENIYA SVOISTV METALLOV I SPLAVOV PRI NAGREVE]
M. G. Lozinskii et al 1970 36 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Otd. Tekhn. Nauk, Izv. (Moscow), no. 6, 1958 p 19–29 Prepared in cooperation with NBS
(TT-70-57076; DMDC-4924) Avail: NTIS CSCL 11F

A short review of application of dynamic methods of measuring modulus of elasticity and internal friction of metals and alloys is given. The apparatus of the new unit of the type meant for studying the dependence of the characteristics on temperature is described. Results of some of the experiments devoted to the study of internal friction in the process of tempering of low alloy structural steel 30KhGSA and study of peak of internal friction in iron caused by the presence of dissolved nitrogen are given. Author (GRA)

N71-19100# National Science Foundation, Washington, D.C.
EFFECTS OF SMALL AMOUNTS OF IMPURITIES ON THE PROCESS OF DISSOCIATION OF A SUPER SATURATED SOLID SOLUTION [K VOPROSY O VLIYANII MALYKH PRIMESEI NA PROTSESS RASPADA PERESYSHCHENNOGO TVERDOGO RASTVORA]
V. I. Arkharov et al 1970 17 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Ural. Fil., Inst. Fiz. Met., Tr. (Moscow), no. 11, 1950 p 104–113
(TT-70-57078; DMDC-5403) Avail: NTIS CSCL 11F

The effect of a number of contaminants (antimony, beryllium, cadmium, aluminum, zinc, tin) in the concentration range of 0.1–0.25% on aging process of silver-copper solid solution at 300–710 C was studied. It was established that antimony, beryllium and cadmium have a considerable effect on the rate of dissociation of supersaturated silver-copper solid solution; the effect of aluminum, zinc and tin in the investigated concentration range is insignificant. The relative effect of small amounts of the above mentioned elements on the kinetics of the process of dissociation of supersaturated silver-copper solid solution is intensified on decreasing the temperature. Author (GRA)

N71-19106# National Science Foundation, Washington, D.C.
DIFFUSION OF SILVER IN IRON-PALLADIUM ALLOYS AND INTERNAL ADSORPTION OF PALLADIUM IN IRON [O DIFFUZII SEREBRA V SPLAVY ZHELEZA S PALLADIEM I O VNVTRENNEI ADSORBTSII PALLADIYA V ZHELEZE]
V. I. Arkharov et al 1970 13 p refs Transl. into ENGLISH from Dokl. Akad. Nuak SSSR (Moscow), v. 94, no. 6, 1954 p 1057–1060 Prepared in cooperation with NBS
(TT-70-57070; DMDC-4316) Avail: NTIS CSCL 11F

Silver was diffused into alloys of iron with molybdenum and palladium 940 C. Grain boundary diffusion was noted. Microhardness readings were used to determine concentration profiles. GRA

N71-19111 Rensselaer Polytechnic Inst., Troy, N.Y.
STRENGTHENING OF AUSTENITIC STAINLESS STEELS BY INTERNAL NITROIDATION
Lynn Edward Kindlimann (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms HC $7.80/Microfilm $3.00 Order No. 70-2623

In the development of a method of strengthening materials through the introduction of a dispersoid of stable nitrides, the internal nitridation of thin sections of austenitic Fe-Cr-Ni-Ti alloys containing up to 4% Ti was studied over the temperature range 1600-2210 F. The rate of internal nitridation was found to fit the theoretical expressions developed for internal oxidation if corrected for the simultaneous formation of both chromium and titanium nitrides. Using these theories, the activation energy for diffusion of nitrogen in an 18CR-12Ni-2Ti alloy was calculated from the data, and is reported as −4.74 + or − 0.3 kcal/mol for the temperature range indicated. The presence of oxygen in the nitriding gas was shown to cause a decrease in nitriding rate due to surface limiting of nitrogen absorption, and became progressively more pronounced as % Ti was increased and temperature was decreased, particularly in boron containing alloys. Dissert. Abstr.

N71-19138# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
GOLD TRANSPORT BY COMPLEX METAL CHLORIDE VAPORS
Judith A. Eisele, D. D. Fischer, H. J. Heinen, and D. G. Kesterke Washington Mar. 1971 15 p refs
(BM-RI-7489) Avail: Issuing Activity

The possibility of improving the volatilization of gold through the formation of a metal-gold chloride vapor complex was investigated. Gold-silica mixtures, containing ferrous and nonferrous minerals and salts as additives, were treated in a laboratory tube furnace with a flow of chlorine gas at various temperatures. The addition of pyrite (FeS2) to a charge of gold-silica increased the volatility of the gold from 3, 20, and 62 percent of the total gold to 62, 93, and 100 percent at 200, 300, and 400 C, respectively. Chemical analyses of the condensated indicated the volatile species to be FeAuCl6. Author

N71-19176# Israel Program for Scientific Translations, Ltd., Jerusalem.
DIFFUSION PROCESSES IN IRON ALLOYS
M. A. Krishtal 1970 238 p refs Transl. into ENGLISH from the book "Diffuzionnye Protsessy v Zheleznykh Splavakh" Moscow, 1963 280 p Sponsored by NBS and NSF Prepared for NBS and NSF
(TT-70-50031) Avail: NTIS

Methods for determining the diffusion coefficients of numerous iron alloys are presented. The main topics are the mechanisms of diffusion, the Kirkendall effect, formation of pores in the body-centered lattice of iron and its alloys, the effect of alloying elements on the diffusion of carbon, the characteristics of vacancies and elements that form substitutional solutions in binary, ternary and quaternary alloys. Methods for measuring the concentration of vacancies are presented. The effect of alloying elements on diffusion and self-diffusion in iron alloys is also considered. Various statistical methods for determining the limiting factors in complex diffusion processes that develop in iron alloys during heat treatment, as well as during combined chemical and heat treatment are discussed. Author (GRA)

N71-19184# Israel Program for Scientific Translations, Ltd., Jerusalem.
DIFFUSION PROCESSES IN METALS
V. N. Svechnikov, ed. 1970 157 p refs Transl. into ENGLISH of the publ. 'Diffuzionnye Protsessy V Metallakh' Kiev, Izvo., 1966 Sponsored by NBS and NSF Prepared for NBS and NSF
(TT-70-50030) Copyright. Avail: NTIS CSCL 11F

This collection of papers was presented at the All-Union Scientific Conference on Diffusion in Metals and Alloys (Kiev, October 1964). Some problems concerning the mechanism and kinetics of various diffusion processes in metals and alloys are explained. Author (GRA)

N71-19216 Oregon State Univ., Corvallis.
EFFECTS OF SELECTED MINOR ALLOYING ADDITIONS ON THE STRUCTURE AND DEFORMATION CHARACTERISTICS OF BERYLLIUM
George Joseph Dooley, III (Ph.D. Thesis) 1969 189 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 70-1438

Solid solution alloying was employed in an attempt to produce some relatively ductile form of beryllium. If the c/a ratio could be significantly altered, it was felt new or different slip systems could be activated. The following elements were selected on the basis of atomic size, melting point, crystal structure and density for adding to beryllium in amounts of 0.5, 1.0, 2.0, 3.0, 4.0, 5.0 and 10.0 atomic percentages: boron, manganese and titanium. All samples were nonconsumable arc melted, machined and sectioned for wet chemical, spectrographic, X-ray diffraction, and metallographic analyses as well as for mechanical (compression) testing.
Dissert. Abstr.

N71-19221 Tennessee Univ., Knoxville.
LOCAL ATOMIC ARRANGEMENTS IN SOME NICKEL-PALLADIUM AND GOLD-PALLADIUM ALLOYS
Wen Lin (Ph.D. Thesis) 1969 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 70-2121

The short-range structures of Ni-Pd alloys containing 25, 50, and 75 atomic per cent Pd and an Au-40 atomic per cent Pd alloy were studied in this research by the single crystal X-ray diffuse scattering technique. An apparatus for growing single crystals using the Bridgman technique was constructed and used to grow the large crystals needed for this research. Measurements of the diffusely scattered X-ray intensities were carried out in the h1h20 plane of reciprocal space for all alloys and for several different heat treatments. In addition, the diffuse intensity distribution was measured throughout a sufficient volume in reciprocal space to effect a quantitative determination of the Warren short-range order parameters and atomic displacements coefficients for two cases. These two cases were the Ni-50 atomic per cent Pd alloy and the Au-40 atomic per cent Pd alloy, both in the slow-cooled condition.
Dissert. Abstr.

N71-19237# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
EVALUATION OF PHYSICAL AND MECHANICAL PROPERTIES OF TYPE 304 STAINLESS STEEL AFTER IRRADIATION TO 3.9 × 10 TO THE 22nd POWER n/sq cm TOTAL FLUENCE
H. J. Busboom and R. R. Asamoto Feb. 1970 34 p refs
(Contract AT(04-3)-189)
(GEAP-13571) Avail: NTIS

A program has been carried out to examine physical and mechanical properties of structural members made from Type 304 stainless steel of EBR-2 subassembly XG05. At the time of its removal from EBR-2, this subassembly had reached a peak fluence at maximum temperatures of 910 F. The results, which include measurements of mechanical properties, density, and helium contents, suggest that the degradation of properties is not disabling to the reactor components at the fluence levels.
Author (NSA)

N71-19271 Military Engineering Experimental Establishment, Christchurch (England).
EFFECT OF AGEING AND FINISHING SEQUENCE ON THE PERFORMANCE OF MARAGING STEEL
Jan. 1970 22 p refs
(MTN-2/70) Copyright. Avail: Issuing Activity

Plain rotating bending fatigue specimens of 90 ton/sq in (1 390 MN/sq m) grade 18% Ni maraging steel were tested in the unaged, the standard heat treatment, aged to peak hardness and overaged conditions. Aging beyond the standard time gradually reduced fatigue properties, whilst unaged material had an endurance limit similar to material aged for the standard time. Grinding as a final operation was beneficial and polishing of ground and maraged specimens produced no significant change in results.
Author

N71-19272 Rensselaer Polytechnic Inst., Troy, N.Y.
STUDIES OF DISCONTINUOUS PRECIPITATION OF GAMMA PRIME IN THE NICKEL-COBALT-ALUMINUM ALLOYS BY TRANSMISSION ELECTRON MICROSCOPY
Prabhakar G. Renavikar (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 70-2640

Continuous and discontinuous precipitation of the gamma prime phase as a function of alloy composition and aging temperature and the growth mechanism of the discontinuous precipitate were studied in a series of nickel-cobalt-aluminum alloys of varying cobalt content by means of transmission electron microscopy over the temperature range from 900 F to 1325 F. Microhardness and tensile test data on the sheet specimens indicated that the finely spaced discontinuous precipitate strengthened the alloys to values equivalent to those attainable by continuous precipitate without an appreciable decrease in ductility. The grain boundary mobility appeared to be a controlling factor for the growth of discontinuous precipitate. The growth of the discontinuous precipitate in the hot stage was restricted; this restriction is attributed to the immobilization of grain boundaries due to surface contamination.
Dissert. Abstr.

N71-19330 Clarkson Coll. of Technology, Potsdam, N.Y.
THE EFFECT OF CYCLIC REDUCTION, OUTGASSING AND OXYGEN ADSORPTION ON THE TOPOGRAPHY AND OXYGEN DESORPTION PROPERTIES OF SILVER
Wendell Kollen (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 70-1464

The effect of a thermochemical surface preparation technique on the topography of silver powder and foil and the desorption of oxygen from the powder has been studied with a microbalance and an electron microscope. The powder and foil were exposed cyclically to outgassing, oxygen adsorption at 5 torr, outgassing and carbon monoxide reduction at 5 torr at a constant temperature chosen from the range 300 C to 400 C. Silver powder was also exposed to isothermal cyclic outgassing and oxygen adsorption at 5 torr at 500 C. The microbalance was used to measure the rate and amount of desorbable oxygen from the powder at various stages of cycling by the techniques of thermodesorption and isothermal desorption.
Dissert. Abstr.

N71-19331# Sandia Corp., Albuquerque, N.Mex. Space Power Advanced Development Div.
OXIDATION OF CERTAIN REFRACTORY ALLOYS
D. J. Mottern Nov. 1970 18 p refs Sponsored by AEC
(SC-DR-70-164) Avail: NTIS

Several refractory metals being considered for isotope capsule structural members were subjected to an oxidizing atmosphere at various temperatures. Results indicate that Ta and Mo alloys oxidize rapidly above 1000 F. The Nb alloy WC-3015 appears to have much better oxidation properties in the temperature regime in which the metals were tested.
Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-18304# Oak Ridge National Lab., Tenn.
DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART 5: PROTECTIVE COATINGS TESTS

J. C. Griess, T. H. Row, C. D. Watson, and G. A. West Oct. 1970 50 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2412-Pt-5) Avail: NTIS

Protective coatings to be used in reactor containment structures were subjected to the high temperature and radiation conditions possible in such containment structures following a design basis accident. It is necessary to assure that the coatings are not removed in large quantities that might inhibit or negate proper operation of emergency cooling equipment. Thirty-five different protective coatings were tested in a recirculating loop facility, while 106 different coatings were placed in the Carolinas-Virginia Test Reactor containment building and subjected to four steam system blowdown tests. In the loop tests the coatings were examined for resistance to two proposed containment spray system solutions, 0.15 m NaOH + 0.28 m Na2S2O3, at several temperatures. Author (NSA)

N71-18389# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ABSORPTION OF He 4 BY ACTIVATED CARBON [ADSORPTION DE L'HELIUM 4 PAR LE CHARBON ACTIF]
P. Roubeau, G. Der Nigohossian, and O. Avenel 1969 7 p refs In FRENCH Presented at Intern. Conf. on Vacuum and Cold, Grenoble, France, 2 – 5 Dec. 1969
(CEA-CONF-1505; CONF-691210-1) Avail: AEC Depository Libraries.

The adsorption of helium-4 on activated carbon was studied between 2 and 80 K at equilibrium pressures from 10 to the – 9th to 10 to the 3rd power mm Hg in order to determine the adsorption parameters more precisely. The results are shown graphically. The uncertainty reaches or exceeds 10% only at pressures below 0.00001 mm Hg, temperatures below 2.5 K, or adsorbed quantities less than 0.01/cu cm/gm or in the region where the dead volume correction reaches 10% (temperatures above 60K). NSA

N71-18484*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE STABLE THERMAL CONTROL COATINGS Triannual Report, 1 May – 30 Sep. 1970
G. A. Zerlaut 30 Nov. 1970 88 p refs
(Contract NAS8-5379)
(NASA-CR-103039; IITRI-U6002-94) Avail: NTIS CSCL 11C

Zinc orthotitanate-pigmented potassium silicate paints were investigated for use as thermal-control surface coatings with stable ratios of solar absorptance to infrared emittance. The effects of irradiation on the spectral reflectance of various Zn2Ti04 paints are discussed. F.O.S.

N71-18485# Aerospace Corp., El Segundo, Calif.
THERMALLY INDUCED STRESS WAVES IN A LAMINATED COMPOSITE Technical Report, Mar. – Jul. 1970
Charles Sve 15 Oct. 1970 33 p refs
(Contract F04701-70-C-0059)
(AD-715896; TR-0059(6240-30)-1; SAMSO-TR-70-419) Avail: NTIS CSCL 11/4

A solution is presented for the response of a periodically laminated elastic half plane subjected to rapid internal heating. The assumed temperature distribution has been used in previous investigations of electromagnetic absorption problems where thermal diffusion may be neglected. The laminations are perpendicular to the free surface of the half plane, and the incident flux is absorbed in each layer according to an exponential decay with depth. Since heat conduction is neglected on this time scale, the temperature distribution is discontinuous at the lamination interfaces. A microstructured continuum theory provides the dispersive model, and a solution is obtained for the composite stress in the far field. Limiting forms of the solution are included for the cases when the radiation is absorbed in the alternate layers only or when dispersion can be neglected. Several numerical examples are presented to illustrate the effect of dispersion. Author (GRA)

N71-18498# Army Materials and Mechanics Research Center, Watertown, Mass.
TRANSMISSION MICROSCOPY OF ION BOMBARDMENT THINNED BORON CARBIDE
R. Nathan Katz and Abram O. King Nov. 1970 9 p refs
(AD-715857; AMMRC-TR-70-31) Avail: NTIS CSCL 11/2

The use of the ion-bombardment etching technique to thin boron carbide ceramics for transmitted light optical and transmission electron microscopy is demonstrated. The results of the transmission electron microscopy provide the first direct evidence of the existence of dislocations in boron carbide. Author (GRA)

N71-18541# Army Materials and Mechanics Research Center, Watertown, Mass.
MICROSTRUCTURAL CHARACTERIZATION OF A PROPRIETARY CERAMIC ARMOR
William P. Clancy and Mary R. Norton Aug. 1970 30 p refs
(AD-715352; AMMRC-TR-70-24) Avail: NTIS CSCL 19/4

As-polished and polished-and-etched sections of a proprietary ceramic armor material were examined by light microscopy in an effort to characterize the microstructure. Regions representing the bulk of the material and random volumes of low X-ray radiographic density were studied. Silicon, silicon carbide, and boron carbide were identified in the bulk of the material whereas titanium monoboride and silicon triboride, in addition to the aforementioned components, were found in the volume of low radiographic density. All of these components could be differentiated in the unetched condition. It is apparent that liquid silicon reacts with boron carbide to form silicon carbide. The latter tends to be transparent. It is suggested that the presence of titanium in the form of TiB is responsible for the low radiographic density. Author (GRA)

N71-18550# Chicago Univ., Ill. James Franck Inst.
HIGH-TEMPERATURE CALORIMETRY OF SOLID IONIC SYSTEMS Final Report, 1 Nov. 1967 – 31 Oct. 1970
Ole J. Kleppa 25 Nov. 1970 9 p
(Contract DA-ARO(D)-31-124-G961)
(AD-715719; AROD-5107-28-MC) Avail: NTIS CSCL 7/4

The report gives a summary of the investigations intended to extend and improve facilities for reaction calorimetry at temperatures up to 1100C, and to apply these facilities to the study of solid ionic systems. Emphasis has been placed on work relating to ceramic materials which cannot readily be explored by the usual room temperature methods. The basic thermodynamic information which one might derive from this work would be of considerable interest in metallurgy, ceramics and geochemistry, as well as in physical-inorganic chemistry. Author (GRA)

N71-18551# Monsanto Research Corp., Dayton, Ohio.
A STUDY OF THE RADIATION STABILITY AND MEANS OF FABRICATING MRC COPOLYMER 250 B FILMS FOR DOSIMETERS Technical Report, 1 May 1968 – 16 Nov. 1970
Ival O. Salyer, George L. Ball, III, Philip H. Wilken, Earl V. Kirkland, and Roger L. Seelig Nov. 1970 66 p
(Contract DAHC20-68-C-0127)
(AD-715417; MRC-DA-255) Avail: NTIS CSCL 11/9

The two major objectives of this study were: to identify the factor or factors responsible for the unique radiation stability of MRC Copolymer 250B and to explore various methods for forming dosimeter quality films from polymer powder. Solution casting, blow extrusion, T-die extrusion, and biaxial orientation were studied. All evidence strongly indicates that the sulfate end group resulting from persulfate initiation is the structural feature responsible for radiation stability of MRC Copolymer 250B. There is evidence suggesting that some specific polar end groups are sufficient to impart radiation stability since hydrogen peroxide initiated polymer is also radiation stable. The possibility that a sulfur-containing emulsifier can contribute to radiation stability also

exists. With the exception of the persulfate initiation, it was shown that no component of the polymerization recipe contributes to radiation stability. However, since it is necessary to use polymer made by the emulsion technique, the process is important. Author (GRA)

N71-18654*# Washington Univ., Seattle. Ceramic Engineering Div.
INTERDISCIPLINARY RESEARCH CONCERNING THE NATURE AND PROPERTIES OF CERAMIC MATERIALS Semiannual Status Report, 16 Jun. – 15 Dec. 1970
James I. Mueller Jan. 1971 66 p refs
(Grant NGL-48-002-004)
(NASA-CR-116809; SASR-15) Avail: NTIS CSCL 11B

General information concerning the ceramic material research conducted during this period is presented. The studies include: effects of chemical environment on ceramic materials, fracture and deformation characteristics, surface phenomena, and fabricating processes. F.O.S.

N71-18656# Cambridge Memories, Inc., Newton, Mass. Magnetic Thin Film Development Dept.
RESEARCH IN FERROMAGNETICS
Harvey I. Jauvtis 15 May 1970 105 p refs
(Contract F19628-69-C-0270)
(AD-715913; Rept-070-S1; AFCRL-70-0398; SR-1) Avail: NTIS CSCL 9/2

The effect of nuclear radiation on domain tip film elements was investigated. Experiments showed that gamma radiation had no affect on magnetic properties or non-volatility of storage devices tested. The causes of failures in domain tip film elements are described and means of eliminating these problems considered. Channels studies concerned with coercivity, fanout, readout, and erase requirements were performed and techniques for evaluating DOT devices were developed. Magnetic shielding was also investigated. Author (GRA)

N71-18657# Stanford Research Inst., Menlo Park, Calif.
THE EFFECT OF FLAME RETARDENTS ON THERMAL DEGRADATION OF ALPHA CELLULOSE IN NITROGEN
Anne E. Lipska Aug. 1970 35 p refs
(Contract DAHC20-70-C-0219)
(AD-715411) Avail: NTIS CSCL 7/4

Measurements for use in assessing the Parker-Lipska model for decomposition of cellulose are reported. These include changes in molecular weight during isothermal pyrolysis and increases in char yield and weight-loss rate due to retardant treatment. These experiments also investigated the role of 1,5-anhydro-2,3-deoxy-beta-D-pent-2-enofuranose (a major product of thermally degraded cellulose and levoglucosan) in the char-formation process of fire-retarded cellulose. The isolated furanose derivative, both in the neat form and in the presence of NH4H2PO4, was pyrolyzed and its degradation products were analyzed by means of a gas chromatograph. At 276C, initial pyrolysis of alpha-cellulose results in an abrupt decrease in average molecular weight and is followed by a linear decrease over a prolonged period of heating. Increased yields of char and rates of degradation due to the basic and neutral retardants were found to be in quantitative agreement with the predictions of the Parker-Lipska model for decomposition of cellulose. The results of the pyrolysis experiments on the furanose derivative support the contention that the excess yield of char in retardant-treated cellulose in due to the degradation of secondary products of cellulose decomposition rather than of the cellulose molecule itself. Author (GRA)

N71-18661# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THERMOELASTIC WAVES IN A PERIODICALLY LAMINATED MEDIUM, JANUARY – MAY 1970
C. Sue 15 Oct. 1970 31 p refs
(Contract F04701-70-C-0059)
(AD-715895; TR-0059(6240-30)-2; SAMSO-TR-70-417) Avail: NTIS CSCL 20/12

The oblique propagation of time-harmonic waves in a periodically laminated composite is studied. Governing equations are those of the coupled thermoelasticity theory for plane strain. The exact dispersion relation in the form of a determinant of order twelve is presented, and several numerical cases are included. Results indicating differing amounts of dispersion and attenuation for various angles of propagation are compared with results from an isothermal analysis. Author (GRA)

N71-18748*# Philco-Ford Corp., Newport Beach, Calif. Aeronautic Div.
LARGE DIAMETER GRAPHITE/CARBON COMPOSITE FILAMENT DEVELOPMENT Final Report
N. E. Quackenbush 24 Jul. 1970 67 p refs
(Contract NAS3-13204)
(NASA-CR-72769) Avail: NTIS CSCL 11D

The feasibility of making large-diameter composite monofilaments was investigated by pyrolyzing high-modulus graphite fiber/high-char polymer composites. Molding, rolling, and wet-die drawing were used to form the monofilaments. The results showed the feasibility of the method. Problems encountered in the impregnation, curing, and pyrolysis steps caused nonuniform distribution of the fibers and porosity and cracking within the pyrolyzed carbon matrix. These problems prevented the composite monofilaments for attaining their full potential properties. The full modulus and up to 80% of fiber tensile strength were retained in the best pyrolyzed composites. Author

N71-18780# Naval Underwater Systems Center, New London, Conn.
THE OPEN-CIRCUIT SENSITIVITY OF AXIALLY POLARIZED FERROELECTRIC CERAMIC CYLINDERS
Charles L. Le Blanc 22 Sep. 1970 35 p refs
(AD-715786; NUSC/NL-4009) Avail: NTIS CSCL 9/1

The open-circuit sensitivities of axially polarized ferroelectric ceramic cylinders are derived by treating the ceramic as an anisotropic material. Although the results for cylinders that are pressure-released at the inside lateral surface were identical to those given by Langevin, the analysis showed that the anisotropic properties of currently used ceramics did not influence the sensitivities of these types of cylindrical hydrophone elements. Axially poled cylinders that were completely pressure-released with respect to the radial coordinate were found to exhibit sensitivities larger than those of similar cylinders that were pressure-released on only one major surface, the inside lateral surface. Included in this report are graphs of the magnitude of the stresses induced in the cylinders by the ambient hydrostattic pressures. Author (GRA)

N71-18824# Brown Univ., Providence, R.I. Dept. of Physics.
MAGNETIC RESONANCE STUDIES OF THE STRUCTURE OF GLASSES Final Report, 1 Jun. 1969 – 31 Aug. 1970
Philip J. Bray Dec. 1970 6 p refs
(Contracts Nonr-562(26); N00014-67-A-0191-0010)
(AD-715463) Avail: NTIS CSCL 11/2

Nuclear magnetic resonance techniques have been used to study atomic arrangements and chemical bonds in glasses. The principal results are as follows: (1) NMR distinguishes between BO3 and BO4, configurations; quantitative measures of each configuration in the glass can be made. (2) The borate anomaly is not related to the number of four-coordinated borons in the glasses. (3) BO3 units with all bridging oxygens can be distinguished from BO3 units with one or two nonbridging oxygens. (4) Lead-oxygen configurations in lead borate and lead silicate glasses have been determined as a function of the glass composition. (5)

Vanadium-oxygen configurations in V2O5-P2O5 glasses, thallium-oxygen configurations in Tl2O-B2O3 glasses, and tellurium-oxygen configurations in TlO2-V2O5 glasses have been determined as a function of composition. (6) Local diffusion of alkali ions in glasses at or near room temperature have been discovered. (7) Theoretical analysis and computer programs have been devised to simulate NMR spectra for comparison with experimental spectra.
Author (GRA)

N71-18825# Harry Diamond Labs., Washington, D.C.
KINETIC STUDY ON POLYPHENYLENE OXIDE
Rainer J. Katzenstein Sep. 1970 30 p refs
(AD-715358; HDL-TR-1530) Avail: NTIS CSCL 7/4

The Arrhenius activation energy and reaction rate constants for polyphenylene oxide (PPO), both unfilled and filled with 30-percent glass fiber, were determined by isothermal and by temperature programmed thermogravimetric (TGA) methods and found to be 45.5, 38.9, 43.1, and 35.6 kcal, respectively. The activation energy as determined by TGA methods is 2 to 3 kcal lower than that determined by the more accurate but tedious isothermal methods. This is in accordance with comparable TGA data published in the literature. Kinetic rate constants calculated from TGA data only are not always comparable to those calculated from isothermal determinations and cannot be used with confidence. The Arrhenius equation was tuilized to predict the thermal loss of glass-filled PPO at elevated temperatures. At maximum temperature that the nose cone of a projectile would see in flight (760C), the loss could be as high as 90 percent in 0.5 sec. Author (GRA)

N71-18927*# General Electric Co., Evendale, Ohio.
DEVELOPMENT OF Cr-Li-Y2O3 COATINGS FOR CHROMIUM-BASE ALLOYS Final Report
J. W. Clark 5 Feb. 1971 85 p refs
(Contract NAS3-11174)
(NASA-CR-72763) Avail: NTIS CSCL 11C

The evaluation of Li-doped, Y2O3-stabilized Cr2O3 surface layers is reported as a means of increasing the resistance of Cr-base alloys to embrittlement in air oxidation, as measured by a change in ductile-brittle transition temperature.The plasma sprayed chromium plus 10 volume percent Y2O3 was the most effective of several coatings studied. Author

N71-18934*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF SPACE ENVIRONMENT FACTORS ON THE MECHANICAL, PHYSICAL, AND OPTICAL PROPERTIES OF SELECTED TRANSPARENT ELASTOMERS
Jerry G. Williams and Joseph H. Judd Washington Feb. 1971 52 p refs
(NASA-TN-D-6216) Avail: NTIS CSCL 11I

An experimental investigation was conducted on four different transparent elastomers (silicone, urethane, ethylene-proplylene, and isoprene rubbers) which are candidate matrix materials for flexible windows on spacecraft. The material mechanical properties were measured over a temperature range of from −100 C to +100 C and after exposure to vacuum, vacuum-heat, and air-heat environments for a period of 30 days. Light transmission through these materials for wavelengths from 230 to 2500 nm was also determined after exposure to environmental conditions. In addition to mechanical and optical properties, measurements were made on specimens to determine vacuum weight loss, gas permeability, the degrading effects of ultraviolet-vacuum exposure, and thermal degradation characteristics. Author

N71-18945# Bendix Aerospace-Electronics Co., Kansas City, Mo.
DETERMINATION OF FOAM DENSITY
C. B. Pettie Oct. 1970 42 p refs
(Contract AT(29-1)-613)
(BDX-613-180) Avail: NTIS

Methods for nondestructively determining the density variations within a block of polystyrene foam were investigated. Efforts were primarily focused on using an X-ray radiation gage (DXT), since there is no known method with better capabilities. The greater the number of DXT views, the better the approximation of the actual density variations within the billet. A Fortran 4 program for computer simulation of DXT information based on random density variation was developed to permit the evaluation of the technique developed without sectioning of actual material. The possibilities of using DXT equipment for this technique were explored mathematically and effects of beams with nonorthogonal orientation were calculated. Author (NSA)

N71-18967*# Franklin Inst., Philadelphia, Pa. Research Labs.
SIMULTANEOUS POLYMERIZATION AND MOLDING OF PYRRONE POLYMERS
P. E. D. Morgan and H. Scott Washington NASA Mar. 1971 51 p refs
(Contract NAS1-8945)
(NASA-CR-1737) Avail: NTIS CSCL 07D

The feasibility of simultaneously polymerizing and molding Pyrrone polymers and obtaining high strength, high modulus, dense thermally stable moldings by starting with monomeric materials was demonstrated. Typical properties of the moldings were: density, 1.29 g/cc; diametral tensile strength, 10,700 psi; ultrasonic modulus, 1.3 million psi; hardness, 83 Rockwell B; and thermal stability in air (at 0.5 C/min), 400 C. Optimization of molding and properties was attempted only for the PMDA (pyromellitic acid or anhydride)DAB (3,3'-diamino benzidine) system. A method designed to mix monomers at a molecular level by preparing 1:1 salts improved modability and thermal stability as well as reproducibility of polymer properties. Interrelationships between molding powder characteristics and molding conditions required to achieve optimum polymer properties were investigated. This demonstration of the feasibility of molding Pyrrones directly from the monomers may now be expected to lead to rapid improvements in the molding of other systems, such as the NTCA (naphthalene tetracarboxylic acid) DAB system. Author

N71-19008*# Utah Univ., Salt Lake City. College of Engineering.
CUMULATIVE DAMAGE EFFECTS OF VISCOELASTIC FRACTURE Semiannual Progress Report
M. L. Williams Jan. 1971 34 p refs
(Grant NGL-45-003-029)
(NASA-CR-116854; UTEC-71-029) Avail: NTIS CSCL 11A

A series of investigations relating to the energy concept of adhesive failure was conducted. A simple pressurized disk test is considered for measuring the adhesive value for a bonded elastomer and for application to a debonding problem in engineering design, debonding of a rubber cylinder from a glass case, debonding between two rubber plates, and the effect of an adhesive interlayer between elastic materials. Means by which such information can be used by engineers to predict failure of adhesive joints are examined. Simple tests by which adhesive energy or strength can be measured until such time as it is possible to predict it reliably from basic material properties are discussed. This quantity can then be used as a design parameter to predict failure for more complex ashesive geometries and loading configurations. Author

N71-19154 Rensselaer Polytechnic Inst., Troy, N.Y.
HARDNESS AND HIGH PRESSURE DEFORMATION MECHANISMS OF GLASS
James Edwin Neely, Jr. (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-2634

The investigation was undertaken to determine the nature and possible variation of the deformation which occurs during indentation in order to define glass hardness. In the study fracture-free Vickers indentations were made at high loads up to 8000 grams. All indentation dimensions were determined from high resolution photomicrographs. It was found that the elastic recovery of indentation depths varied from 19 to 53% for the glasses investigated. It was observed that as the per cent elastic recovery increased, the maximum load which could be used to obtain fracture-free indentations generally increased. No relation was observed to exist between elastic deformation and Vickers hardness for the variety of glasses indented. The size of indentations in silica glass was shown to be independent of the elastic recovery of the indentation depth. It was concluded that the deformation which leads to the formation of the indentations is independent of elastic deformation. Dissert. Abstr.

N71-19155 Lehigh Univ., Bethlehem, Pa.
DEPOSITION, PROPERTIES, AND INTERFACE CHARACTERISTIC OF SILICON NITRIDE FILMS ON SILICON
Karel Hugh Olson (Ph.D. Thesis) 1969 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 70-1737

The properties and interface characteristics were determined for silicon nitride films deposited on silicon using a horizontal tube furnace. The properties of the films which were determined include index of refraction, dielectric constant, dielectric field strength, and acid resistance. The index of retraction was nearly constant at 2.0 for wave lengths above 350 millimicrons. The dielectric constant was found to be 6.8 + or − 0.7, and field strength was about 5 million V/cm. Concentrated hydrofluoric acid etched the silicon nitride at a rate of 150 to 175 A per minute. Metal-insulator-semiconductor structures were formed by evaporating gold dots on the deposited silicon nitride film. This structure exhibited tunneling characteristics for silicon nitride films less than 30 A thick on very low resistivity silicon. Thicker films (35A to 800A) resulted in capacitance and conductance characteristics generally similar to those reported for thick oxides on silicon. Dissert. Abstr.

N71-19222*# Little (Arthur D.), Inc., Cambridge, Mass.
PRODUCTION OF OXIDE FIBERS BY A FLOATING ZONE FIBER DRAWING TECHNIQUE Final Report
J. S. Haggerty and W. P. Menashi Feb. 1971 95 p refs
(Contract NAS3-13479)
(NASA-CR-72811; ADL-71997) Avail: NTIS CSCL 11C

Single crystal sapphire (Al_2O_3) fibers were grown by a highly attenuated floating zone process. Detailed heat transfer and zone shape analyses were made to determine power requirements, the suitability of potential heat sources, and dimensional limits for reliable fiber growth. On the basis of these analyses, fiber growth experiments were initiated with CO_2 laser and incandescent heat sources. Room temperature and elevated temperature tensile tests showed the fiber strengths to be sensitive to process conditions and feed rod composition. Chromium doped fibers (ruby) had higher elevated temperature tensile strengths than high purity sapphire fibers. Author

N71-19225*# Avco Corp., Lowell, Mass. Systems Div.
DEFORMATION PROCESSES IN FORGING CERAMICS Summary Report, Jun. 1969 - Aug. 1970
R. M. Cannon and W. H. Rhodes Aug. 1970 75 p refs
(Contract NASw-1914)
(NASA-CR-116896; AVSD-0619-70-CR) Avail: NTIS CSCL 11C

The deformation processes involved in forging polycrystalline oxide ceramics were investigated. A combination of mechanical testing and forging experiments were performed on fine-grained Al_2O_3. The combination of mechanical tests and microstructural evaluation indicated that at very fine grain sizes the deformation mechanism occurs by a non-Newtonian grain boundary sliding process. In addition, considerable evidence was found for a substantial contribution of basal slip to the grain shape accommodation process. Preferential crack formation was found at inhomogeneities in the specimens; the appearance and growth of these cracks was more rapid at higher strain rates and stresses. The results of several forgings combined with the mechanical tests support the view that there is sufficient ductility in fine-grained Al_2O_3 to allow forging at moderate temperatures. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N71-18279# Central Research Inst. for Physics, Budapest (Hungary).
SL(2,C) REPRESENTATIONS IN EXPLICITLY ENERGY DEPENDENT BASIS
K. Szego and K. Toth 1970 17 p refs
(KFKI-70-16-HEP) Avail: AEC Depository Libraries

Unitary and nonunitary representations of the SL(2,C) group are investigated in such a basis, in which the subgroup diagonalized is that one, which in the four dimensional representation leaves invariant the four vector p sub mu = [(1 + v/2)0, 0, (1 − v/2)] for arbitrary real value of p sub mu to the 2nd power = v. The split of the representation space into irreducible subspaces changes smoothly when varying the value of v. The formalism is of importance in physical theories which postulate analyticity requirements and Lorentz invariance simultaneously. Explicit basis functions of the representation spaces are constructed. Author (NSA)

N71-18356# Stanford Univ., Calif. Dept. of Operations Research.
OPTIMAL CONTROL OF A SINGLE-SERVER QUEUE WITH BALKING AND RENEGING
Joseph D. Blackburn 16 Nov. 1970 68 p
(Contract N00014-67-A-0112-0058, Grant NSF GK-2925)
(AD-714802; TR-19) Avail: NTIS CSCL 12/2

Models are developed for intermittent operation of the service facility in a single-server queue with Poisson arrivals and general service-time distribution. When the server is inoperative for periods of time, customer losses from the queue by halting and reneging can be significant. To account for this effect, provisions for balking and reneging are included in the models. Balking is handled by a simple modification of the arrival rate parameters. Reneging, which is allowed only when the server is shut down, is characterized by a Poisson process whose rate is dependent on the number of customers in the queue. Two models are considered for the reneging process: the occurrence of the reneging event results in the loss of either all the customers in the queue (model I) or a single customer (model II). A number of applications for these models are discussed. A reward structure is specified and stationary optimal policies are found which maximize the expected discounted reward over an infinite horizon. The optimal policies have a simple critical-number characterization in terms of the number of customers in the queue. Algorithms for computing the critical numbers are described. Author (GRA)

N71-18419# Translation Consultants, Ltd., Arlington, Va.
APPLICATION OF THE CALCULUS OF VARIATIONS TO THE DESIGN OF MINIMUM-VOLUME STRUCTURES [O

PRIMENENII VARIATSIONNOGO ISCHISLENIYA K RASCHETU KONSTRUKTSIY NAIMEN'SHEGO OBYEMA]
Yu. K. Sirazutdinov Washington NASA Feb. 1971 3 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. Ser. Prikladnaya Mekhan. (Kazan), no. 95, 1968 p 100–110
(Contract NASw-2038)
(NASA-TT-F-13449) Avail: NTIS CSCL 12A

The problem of determining the optimal shape of the cross sections (optimal height-to-width ratio) and optimum distribution of the cross sections along statically determinable and statically indeterminable beams is discussed. A solution is obtained with the aid of a variational approach, modified in the sense that the variational methods are tailored to fit the anomalies of the problem. The Euler-Lagrange equations are derived and are used to obtain the minimum-weight (volume) equations for statically indeterminable conventional beams, I beams, and box beams. The results are applied as an example to the minimum-weight design of a concrete box beam clamped at each end. Author

N71-18497*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
ASYMPTOTIC STABILITY PROPERTIES OF LINEAR VOLTERRA INTEGRODIFFERENTIAL EQUATIONS
R. K. Miller [1970] 34 p refs
(Grants NGL-40-002-015; AF-AFOSR-0693-67B)
(NASA-CR-116797) Avail: NTIS CSCL 12A

The Lyapunov stability properties of solutions of a system of Volterra integrodifferential equations are studied. It is proved that if B(t) is contained in L sup 1(0, infinity), then R(t) is of class L sup 1(0, infinity) if and only if the trivial solution of system (L) is uniformly asymptotically stable. Various types of Lyapunov stability for (L) are defined and some sufficient conditions on A and B(t) are given in order that the trivial solution of (L) is stable, uniformly stable, asymptotically stable, or uniformly asymptotically stable. Author

N71-18629*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RANDOMLY FLUCTUATING FLOW IN A CHANNEL DUE TO RANDOMLY FLUCTUATING PRESSURE GRADIENTS
Morris Perlmutter Washington Mar. 1971 32 p refs
(NASA-TN-D-6213; E-5851) Avail: NTIS CSCL 20D

A randomly fluctuating pressure gradient of a stationary Gaussian Markovian form will cause a randomly fluctuating velocity to be superimposed on the steady incompressible flow in a channel. Correlations, spectra, and frequency response functions for the random functions are given. Random pressure signals were generated using Fourier series expansion with coefficients randomly picked from distributions whose parameters were obtained from the spectra of the pressure signal. The random velocity signals were then obtained from the pressure signal by use of the frequency response function calculated from the equation of motion. The increased power loss due to the fluctuations is given and the random pressure and velocity signals are compared for amplitude, frequency, and time lag. Author

N71-18846# Rome Univ. (Italy). Ist. di Fisica.
SOLUTION OF THE ONE-DIMENSIONAL N BODY PROBLEMS WITH QUADRATIC AND/OR INVERSELY QUADRATIC PAIR POTENTIALS
F. Calogero 29 May 1970 49 p refs Submitted for publication Prepared in cooperation with Acad. of Sci. (USSR), Moscow *Its* Nota Interna No. 267
Avail: NTIS

The quantum-mechanical problems of N one-dimensional equal particles of mass m interacting pairwise via quadratic (harmonic) or inversely quadratic (centrifugal) potentials are solved. In the first case, the complete energy spectrum is given. A more general model is solved, in which the N particles are divided into families, with the same quadratic interaction acting between all pairs, but with the inversely quadratic interaction acting only between particles belonging to the same family, with a strength that may be different for different families. The second model contains only scattering states. It is proved that an initial scattering configuration goes over into a final configuration characterized by the given momenta. Author

N71-18892# University of Southern Calif., Los Angeles. Dept. of Mathematics.
MATHEMATICS, SYSTEMS, AND SOCIETY: AN INFORMAL ESSAY
Richard Bellman and Goran Borg (Royal Inst. of Tech.) Dec. 1970 96 p refs
(Contract AT(11-1)-1113; Grants NIH GM-16197-03; NSF GP-20423)
(TR-70-58) Avail: Issuing Activity

Decisions affecting society arising in connection with mathematics and its applications are discussed to provide some systematic ways of thinking about questions of this nature. It is emphasized that mathematics has constantly responded to the conceptual needs of society in the past and that it is well suited to respond to current needs. Ways in which mathematics provided conceptual structures for the approach to past problems of society are illustrated. Some of the reasons why certain major questions escape a traditional mathematical solution are discussed, and some of the modern methods that can be used to provide partial answers are described. Esthetic and artistic aspects of mathematics are also considered. N.E.N.

N71-18893# University of Southern Calif., Los Angeles. Dept. of Mathematics.
FUNCTIONAL EQUATIONS IN THE THEORY OF DYNAMIC PROGRAMMING. 18: A PROBLEM CONNECTED WITH THE VALUE OF INFORMATION
Richard Bellman Nov. 1970 7 p refs
(Grant NIH GM-16197-03)
(TR-70-48) Avail: Issuing Activity

Functional equations for multistage decision process associated with communication theory are discussed. Assumptions are made leading to simultaneous equations, which are solved for a specific case. In general, however, it is felt that the simultaneous equations appear intransigent. N.E.N.

N71-18921# Boeing Scientific Research Labs., Seattle, Wash. Mathematical and Information Sciences Lab.
REVIEW AND CRITIQUE OF SOME PROCEDURES AND RESULTS IN NONLINEAR ESTIMATION
F. C. Johnson and J. S. Meditch Sep. 1970 42 p refs Prepared in cooperation with Carlifornia Univ., Irvine
(AD-715631; D1-82-1001-30) Avail: NTIS CSCL 12/1

Procedures and results in nonlinear estimation are reviewed and critiqued. Both theory and applications are discussed. The theoretical work is concerned with least-squares parameter estimation and marginal maximum likelihood filtering and smoothing for discrete-time nonlinear dynamic systems. Application studies which are examined include 747 stability and control derivatives estimation from flight test data, estimation of human respiratory system parameters from test data, and Apollo orbit determination from tracking ship data. Author (GRA)

N71-18947 Stanford Univ., Calif.
PROLATE SPHEROIDAL WAVEFORM EXPANSIONS FOR COMPUTER-AIDED SIGNAL PROCESSING
Jerome Charles Woodard (Ph.D. Thesis) 1969 123 p

Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-1632

A practical method for computing direct and inverse Fourier transforms based on finite length records taken from data waveforms is described. The method produces greater accuracy than the finite Fourier (trigonometric) transform by employing a specific complete orthonormal set of basis functions corresponding to prolate spheroidal wave functions, to represent the true Fourier transform of a given function by means of series expansion where the unknown expansion coefficients are calculated from a limited record of the given function. Dissert. Abstr.

N71-18959*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

GENERALIZATIONS OF LAGRANGE'S EXPANSION COMBINED WITH LIGHTHILL'S TECHNIQUE FOR UNIFORMIZING SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

E. Dale Martin Washington Mar. 1971 25 p refs
(NASA-TN-D-6245; A-3699) Avail: NTIS CSCL 12A

Use of Lighthill's technique to uniformize approximate solutions of partial differential equations is simplified by incorporating it into a perturbation-exapnsion scheme based on a higher dimensional generalization of Lagrange's expansion. Lighthill's technique is made easier to apply by use of explicit formulas for the uniformized solution in terms of the previously determined nonuniform solution. Results of this study also indicate that Lighthill's technique can be more useful than realized previously. As one example, uniformly valid thin-airfoil solutions can be obtained, by the direct procedure, to any higher order of approximation. Author

N71-18961 Stanford Univ. Calif.

SAMPLING OF CONTINUOUS TIME MARKOV PROCESSES

Gordonkock Keon Leong (Ph.D. thesis) 1969 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 70-1565

A search problem where many dynamic objects or targets are monitored by a search (observation) system that has limited capability is discussed. Each target is modeled by a continuous time Markov process with several states, some of which are observable through distinct windows (cells) of the observation system. Periodically, the search system activates one of the cells and can detect those targets occupying states observable through the activated cell at the time of the search. Each search is termed a search stage, and a total of N searches is made. Several search configurations are examined within the framework of a sequential search problem, using dynamic programming methods with entropy-related objective functions and a cost/reward criterion. Dissert. Abstr.

N71-18988# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.

A NETWORK APPROACH TO THE SYNTHESIS AND IDENTIFICATION OF TAPERED DISTRIBUTED PARAMETER SYSTEMS. 2: A FILTER PROBLEM

Anil Jain and Gerald Cohen May 1970 15 p refs
(Grant NIH GM-16197-02)
(TR-70-28) Avail: Issuing Activity

An equivalent network is used to formulate and solve a distributed filter design problem. Such problems find wide application in the synthesis and identification of distributed parameter systems. A chebychev type criterion is considered for the purpose of design and/or identification. Author

N71-19007# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.

RELIABILITY ANALYSIS OF A MULTIPLE UNIT STANDBY REDUNDANT SYSTEM WITH PREVENTIVE MAINTENANCE

Shunji Osaki Jan. 1971 26 p refs
(Grant NIH GM-16197-03)
(TR-71-3) Avail: Issuing Activity

A standby redundant model of (r+1) units, is considered in which one unit is assumed to be operative and the other units are in standby at time t=0. If the operative unit fails, a unit in standby is put into operation and the repair of the failed unit begins. The preventive maintenance policy of the operative unit to maintain the system with high reliability is examined. The Laplace-Stieljes transform of the time distribution to the first system down and the mean time to the first system down are derived by applying the relationship between Markov renewal processes and signal flow graphs. The behavior after the system down is investigated by using the results of Markov renewal processes. Author

N71-19008 Calif. Univ., Los Angeles.

NEW RESULTS IN FOURIER TRANSFORM ESTIMATION FROM SAMPLED SIGNALS

Robert William Elsner (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 70-2197

Any given model, defined in advance with the aid of a priori information, contains a number of unknown parameters. Corresponding to this Fourier transform model, there is also a sampled sequence of time finctions each of which is dependent on the unknown parameters. These unknown parameters are selected to minimize the mean square error between an observed time sequence, corresponding to the true Fourier transform, and the sequence of model time functions. The given concept is developed in detail for a relatively general class of Fourier transform models. Parameter estimation equations are developed and the solution of these equations is greatly simplified by direct application of the fast Fourier transform algorithm. A sequential algorithm is developed which up-dates and improves the Fourier transform estimate as each new time sample is observed. This algorithm resembles a discrete Kalman filter. Dissert. Abstr.

N71-19034 California Univ., Los Angeles.

PROBLEMS OF SINGULARITY AND DUALITY IN LINEAR ESTIMATION AND CONTROL

Kurt William Simon (Ph.D. Thesis) 1969 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-2260

Results in the estimation of the state of linear systems in the presence of Gauss-Markov noise processes are examined and a new proof is provided for these results. The results are then extended in several directions, namely: to continuous-time filtering of systems with measurements corrupted by noise with non-invertible covariance matrix; to optimal control problems whose cost is not a positive-definite function of the control; and to discrete-time colored-noise filtering problems. The extension to optimal control is accomplished by exploiting the duality of linear estimation and control, which is derived from duality concepts in mathematical programming. The extension to discrete-time filtering is further extended to provide a useful method of reducing the number of simultaneous equations required by the usual white-noise, discrete-time Kalman filter. Dissert. Abstr.

N71-19035*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

VARIANCE REDUCTION BY IMPORTANCE SAMPLING AND THE METHOD OF SPLITTING IN MONTE CARLO CALCULATIONS

Burt M. Rosenbaum Washington Mar. 1971 77 p refs
(NASA-TN-D-6209; E-5793) Avail: NTIS CSCL 12A

The two techniques of variance reduction that are considered

are: (1) importance sampling, and (2) splitting and Russian roulette. Based on the value of the variance, optimum biasing sampling procedures are investigated and it is determined when adjoint biasing yields the minimum variance. It is shown that the method of Russian roulette may lead to an increase, rather than a decrease, in variance. A short example illustrates the methods used. Author

N71-19156 Delaware Univ., Newark.
AN APPROACH TO HAMILTONIZATION AND QUANTIZATION OF RADIATIVELY DAMPED SYSTEMS
William George Sutcliffe (Ph.D. Thesis) 1969 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-1907

A general program for proceeding from Newton's second law, including non-conservative forces, to a quantum mechanical equation of motion is proposed. A method of handling equations of motion containing higher order derivatives, viz., order reduction, is demonstrated for the radiation damping force. The Lorentz covariance requirements of the order reduced force of radiation damping are obtained. The construction of constants of the motion that reduce to energy and angular momentum in the absence of damping is illustrated. These constants appear to be multivalued for non-conservative systems. A procedure to restate equations of motion as a canonical action principle is demonstrated. An unambiguous quantization process and the definition of the Hamiltonian operator in terms of the classical Hamiltonian function is presented. Dissert. Abstr.

N71-19157 Oregon Univ., Eugene.
A NEW APPROACH FOR THE JUSTIFICATION OF ENSEMBLES IN QUANTUM STATISTICAL MECHANICS
Joe Edward Keizer (Ph.D. Thesis) 1969 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 70-2516

The use of Gibbsian ensemble averages is a basic technique in quantum statistical mechanics. What is not known is why the method of ensembles works and it is this question to which the study is directed. In order to motivate the approach, it is made plausible that measurements are by nature ensemble averages. This notion is then given an exact mathematical formulation by introducing a class of linear operators called local operators. The culmination of this development is a complete characterization of the bounded local operators. In order to connect this formal ensemble to statistical mechanical ensembles, attention is restricted to large systems, which are effectively unperturbed by the presence of an additional particle. For such systems a kind of coarse-graining in configuration space is introduced which insures that the ensemble is representative. Finally for certain kinds of incomplete preparations it is shown that the formal ensemble reduces to the equally weighted representative ensemble of Gibbs. Dissert. Abstr.

N71-19185*# International Business Machines Corp., Cambridge, Mass. Boston Programming Center.
PROCEEDINGS OF THE 1968 SUMMER INSTITUTE ON SYMBOLIC MATHEMATICAL COMPUTATION
Robert G. Tobey, ed. Jun. 1969 307 p refs Inst. held at Boston, 24 Jun.–16 Aug. 1968
(Grant NSR-34-003-039; Contract N00014-68-C-0479)
(NASA-CR-116915; FSC69-0312) Avail: NTIS HC $6.00/MF $0.95 CSCL 12A

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13. SIGNIFICANT PROBLEMS IN SYMBOLIC MATHEMATICS R. G. Tobey (Argonne Natl. Lab., Ill.) p 307–324 refs (See N71-19198 08-19)

N71-19186*# Stanford Univ., Calif. Dept. of Physics.
THE PROBLEM OF SUBSTITUTION
Anthony C. Hearn *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 3–19 refs (See N71-19185 09-19)
(Contracts F44620-68-C-0075; ARPA SD-183)
Avail: NTIS HC $6.00/MF $0.95 CSCL 12A

Minimizing intermediate expression swell is a central problem in symbolic mathematics system design. The strategy chosen for implementing substitution is considered as the key to keeping storage space requirements under control. The REDUCE system and its approach to substitution to reduce the complexity of program output is also covered. Author

N71-19187*# International Business Machines Corp., Cambridge, Mass. Boston Programming Center.
DESIGN AND DATA STRUCTURE: FORMAC ORGANIZATION IN RETROSPECT
Peter Marks *In its* Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 21–36 refs (See N71-19185 08-19)
Avail: NTIS HC $6.00/MF $0.95 CSCL 12A

The interaction between FORMAC data organization and algorithm design is considered. Several organizational improvements are discussed. Author

N71-19188*# Naval Ship Research and Development Center, Washington, D.C. Applied Mathematics Lab.
CALCULATION OF TABLES OF INVERSES AND

DETERMINANTS OF FINITE SEGMENTS OF THE HILBERT MATRIX

Elizabeth Cuthill *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 39–53 refs (See N71-19185 08-19)

Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

Tables of inverses and determinants of finite segments of the Hilbert matrices from order 2 to order 37 are calculated using variable precision rational arithmetic. The evaluation of the determinants is carried out to order 62. The matrices arise in least squares fitting of polynomials and are useful in estimating the mean value function of certain stochastic processes and in testing computer subroutines for inversion of matrices. Author

N71-19189*# International Business Machines Corp., Cambridge, Mass. Boston Programming Center.

THE SCOPE FORMAC LANGUAGE

Robert G. Tobey and John D. Lipson (Harvard Univ.) *In its* Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 55–68 refs (See N71-19185 08-19)

(Contract NAS12-87)

Avail: NTIS HC$6.00/MF $0.95 CSCL 12A

The Scope FORMAC System is identified as an experimental on-line interactive symbolic prototype implemented on the IBM 2250 graphic display unit. The language for this system is described and gives the user access to the FORMAC capability in an interactive environment. Sample programs and output are presented. Author

N71-19190*# Harvard Univ., Cambridge, Mass. Graduate School of Arts and Sciences.

AN ATTEMPT TO SOLVE DIFFERENTIAL EQUATIONS SYMBOLICALLY

Stanley B. Gershwin *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 69–75 refs (See N71-19185 08-19)

Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

A set of experimental programs was written in the interactive FORMAC language to implement Picard iteration in solving systems of ordinary differential equations. The reasons why this method is apparently impractical are discussed, and possible remedies are suggested. Author

N71-19191*# Harvard Univ., Cambridge, Mass. Graduate School of Arts and Sciences.

SOME SYMBOLIC COMPUTATIONS IN FINITE FIELDS

Henry A. Feldman *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 77–96 refs (See N71-19185 08-19)

Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

The elementary theory of finite fields and a report on some symbolic computations suggested by that theory are presented. The computations, carried out in FORMAC, chiefly involve modular polynomial arithmetic. The issue of generality versus special-purpose efficiency in a symbol manipulation language is discussed with respect to the suitability of FORMAC for the project. Author

N71-19192*# Rhode Island Univ., Kingston. Dept. of Physics.

SYMBOLIC-NUMERIC EIGENVALUE PROBLEMS IN QUANTUM MECHANICS

Kenneth Hartt *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 97–109 refs (See N71-19185 08-19)

Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

The problem of symbolic numeric conversion (SINCON) is discussed in the context of solving quantum mechanical eigenvalue problems with FORMAC. The eventual use of SINCON in a problem eliminates the need for containing the entire structure of each FORMAC expression in a single equality. Consequently, special coding techniques which reduce core storage requirements (called reductions) are possible Using an example involving SINCON for illustration, the methods of performing reduction by explicit FORMAC coding are given. It is argued that a new version of FORMAC incorporating automatic reduction techniques is needed. Two alternative reduction devices are discussed. Author

N71-19193*# Harvard Univ., Cambridge, Mass. Graduate School of Arts and Sciences.

THE USE OF COMPUTER AIDED SYMBOLIC MATHEMATICS TO EXPLORE THE HIGHER DERIVATIVES OF BELLMAN'S EQUATION

Stanley B. Gershwin *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 111–130 refs (See N71-19185 08-19)

Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

The FORMAC system is used to solve the problem in optimal control theory of how the third and higher space derivatives of the optimal value function behave along the optimal trajectory. Bellman's equation is analyzed by taking derivatives of all orders. It is found that, unlike the second derivative which satisfies a nonlinear equation, the third and higher derivatives of the optimal value function satisfy linear differential equations along the optimal trajectory. Analysis of those equations shows that if certain conditions are satisfied, their solutions are unique and bounded. Consequently, all partial derivatives of the optimal feedback control function are unique and bounded. A general algorithm is proposed for numerically solving optimal control problems using the higher derivatives. The differential equations for the third and fourth derivatives are displayed. Author

N71-19194*# System Development Corp., Santa Monica, Calif.

SYMBOLIC INTEGRATION OF ELEMENTARY FUNCTIONS

Robert H. Risch (IBM, Yorktown Heights, N.Y.) *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 133–147 refs (See N71-19185 08-19)

Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

The problem implied by symbolic integration of elementary functions is discussed with respect to the issues that arise in attempting a formulation, the proposed formulation, and the work done toward its solution. Actual examples are worked, employing an algorithm for the integration of functions built up using logarithms, exponentials, and rational operations. Author

N71-19195*# Wisconsin Univ., Madison. Dept. of Computer Sciences.

ASYMPTOTICS FOR FORMULA MANIPULATION

John H. Halton *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 149–194 refs (See N71-19185 08-19)

Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

Proposals are presented for the implementation, in a computer formula-manipulation system, of a sub-program for computing and manipulating asymptotic expansions. The first part reviews the relevant mathematical theory and the second part discusses implementation of the computations involved in an asympotic package given a limit-subprogram. Notions of commensurate functions and of natural asymptotic expansions are proposed. Algorithms are given for forming linear combinations, products, and arbitrary real powers of given asymptotic expansions. Possible extensions and difficulties are considered. Author

N71-19196*# Wisconsin Univ., Madison. Dept. of Computer Sciences.

COMPUTING TIME ANALYSES FOR SOME ARITHMETIC

AND ALGEBRAIC ALGORITHMS
George E. Collins *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 195–231 refs (See N71-19185 08-19)
(Grant NSF GJ-239)
Avail: NTIS HC$6.00/ME$0.95 CSCL 12A

Computing time bounds are derived for the given polynomial reduced sequence algorithm for computing the greatest common divisor (g.c.d.) of two polynomials with integer coefficients. A g.c.d. algorithm which uses congruence arithmetic is presented. The computing time of the algorithm is analyzed, and it is shown to be more efficient than a previous one. Using easily obtained bounds for operations on large integers, computing time bounds are derived for the integer Euclidean algorithm, extended Euclidean algorithm, and the Chinese remainder theorem algorithm. Author

N71-19197*# Harvard Univ., Cambridge, Mass. Graduate School of Arts and Sciences.
SYMBOLIC METHODS FOR THE COMPUTER SOLUTION OF LINEAR EQUATIONS WITH APPLICATIONS TO FLOWGRAPHS
John D. Lipson *In* IBM Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 233–303 refs Supported in part by ONR (See N71-19185 08-19)
Avail: NTIS HC$6.00/MF$0.95 CSCL 12A

A method of solution based on a multivariate polynomial extension of the two-step integer-preserving elimination algorithm, which avoids the necessity for time-consuming rational function arithmetic, is proposed. This two-step method is compared with the classical one-step method in the context of multivariate polynomial domains and is found to be considerably superior. The proposed fraction-free algorithm is used as the basis for a method of computing the generating function of a flowgraph, superior to the traditional node elimination technique. The application of flow graphs to enumeration problems of combinatorial analysis and automata theory is presented. Proposed algorithms are implemented using the IBM 2250 Scope FORMAC System. The 2250 listings, along with sample output, are presented. Author

N71-19198*# International Business Machines Corp., Cambridge, Mass. Boston Programming Center.
SIGNIFICANT PROBLEMS IN SYMBOLIC MATHEMATICS
Robert G. Tobey (Argonne Natl. Lab.) *In its* Proc. of the 1968 Summer Inst. on Symbolic Mathematical Computation Jun. 1969 p 307–324 refs (See N71-19185 08-19)
Avail: NTIS HC$6.00/ME$0.95 CSCL 12A

The solution of symbolic mathematics problems as practical tools in a batch processing environment is discussed. The problems are divided into six categories: simplification, partitioning of the elementary transcendental functions, design of polynomial systems, encoding and representation, development of mathematical algorithms, and analysis and evaluation. The context of each problem is defined, the problem is stated clearly, and an attempt is made to identify the prerequisite knowledge and skills for solution. R.B.

N71-19204*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
STABILITY AND EXISTENCE OF DIFFUSIONS WITH DISCONTINUOUS OR RAPIDLY GROWING DRIFT TERMS
H. J. Kushner [1970] 23 p refs
(Grants NGL-40-002-015; NSF GK-24485; AF-AFOSR-0693-67D) (NASA-CR-116878) Avail: NTIS CSCL 12A

Stochastic differential equations whose drift terms do not satisfy the usual (Ito) Lipschitz or linear growth conditions in the state occur frequently as models in stochastic control theory. Local stability properties are useful for proving global existence for ordinary differential equations whose right hand sides grow too fast or are not Lipschitz in the state. A local stochastic stability property is used to prove global existence, stability, ergodicity, and the strong Markov and other properties, for a class of diffusions which occur frequently as models. Author

N71-19226# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROPAGATION IN A MEDIUM WITH LARGE-SCALE INHOMOGENEITIES. SMOOTH PERTURBATIONS METHOD
S. M. Rytov 1966 12 p Transl. into ENGLISH of the book "Vvednie v Statisticheskuiu Radiofiziku" Moscow, Nauka, 1966 p 379–394
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

In the case of large-scale inhomogeneities of a medium, the dynamical part of the problem is subject to solution in near-geometric approximations. By using this solution, the statistical characteristics of the wave field can be obtained; however, the method does not yield the wave function directly, but its complex phase psi. The transition to the function psi and subsequent application of the perturbation method were initially proposed in application to the purely dynamical problem of light diffraction by ultrasonic waves. The characteristics of the function psi (its real and imaginary parts) are evaluated in the statistical problem. Author

N71-19227# Hunter Coll., New York.
LENGTHS AND MODULI
Linda Keen [1970] 18 p refs
(Grant NSF G-8789)
Avail: Issuing Activity

Let S be a closed Riemann surface of genus g from which m conformal disks have been removed. S has signature (g;m). The Teichmuller space T(S) is a topological manifold of real dimension tau = 6g − 6 + 3m and has a natural real analytic structure. A set of global real analytic coordinates for this space have been described previously. They are the traces of certain matrices in SL(2,R), which determine the Fuchsian group representing S. A set of global real analytic coordinates are defined, which are also traces of matrices of SL(2,R), but all the matrices involved correspond to elements of the Fuchsian group. Moreover, these moduli all have a geometric interpretation on the surface S as lengths of certain simple closed geodesics. The given figures illustrate the geodesics whose lengths are moduli in the special case of a surface of signature (2;0) and the more general case of a surface. Author

N71-19228# Rome Univ. (Italy). Ist. di Fisica.
THE HYPERSPHERICAL-EXPANSION APPROACH TO NUCLEAR BOUND STATES. 3: THE LIMIT OF LARGE A
F. Calogero, Yu. A. Simonov, and E. L. Surkov 7 Sep. 1970 30 p refs Submitted for publication Prepared in cooperation with Acad. of Sci., Moscow *Its* Nota Interna No. 282
Avail: NTIS

The hyperspherical-expansion approach to nuclear bound states is shown to behave correctly in the first approximation in the limit of large A (A = nucleon number), provided the (input) nucleon-nucleon potential is of the soft-core saturating type recently suggested as the most likely candidate for physical relevance. A derivation from the first principle of the Weizsaecker formula in the large A region is provided, including explicit expressions for the computation of its numerical coefficients. This formula provides a rigorous upper bound to the ground-state energy of an assembly of many nucleons (nuclear matter). An expression for the density of nuclear matter is also derived, which is convenient for studying the dependence of this quantity on the Coulomb interaction and on the difference between the numbers of neutrons and protons. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-18453# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

METEOROLOGICAL TRANSACTIONS, VOLUME 73, NO 1. THE INTERPRETATION OF SATELLITE PICTURES: THE PICTURE OF THE SURFACE OF THE EARTH [METEOROLOGISCHE ABHANDLUNGEN, BAND 73, HEFT 1: DIE INTERPRETATION VON SATELLITENAUFNAHMEN: DAS BILD DER ERDOBERFLAECHE]

Ingrid Haupt 1970 334 p refs In GERMAN; ENGLISH summary Original contains Color Illustrations

Avail: NTIS HC$6.00/MF$0.95

The basis is given for an interpretation of satellite pictures of Europe, Asia, and Africa., taken by the Tiros, Nimbus, and Essa weather satellites. In special cases and for purposes of comparison, pictures taken during Gemini space flights and those taken by the Applications Technology Satellite (ATS) are referred to. ESRO

N71-18458# Snow, Ice, and Permafrost Research Establishment, Wilmette, Ill.

ON SNOW-STORMS

Hideo Arai et al 1970 10 p refs Transl. into ENGLISH from Japanese Rept. Prepared by New York Univ., N.Y. for Snow, Ice, and Permafrost Res. Estab.

(AD-715729) Avail: NTIS CSCL 4/2

The developing conditions of snow-storms, shifting quantities of flying snow, vertical distribution of flying snow and so on have been studied by people concerned with counter-measures against snowdrift damages. Whereas numerous data are available on the developing conditions, sufficient data are hard to find on the shifting quantities and vertical distribution that have larger bearing in the problem of snowdrift. The authors, also engaged in the investigations on the performance of snow fences and shelterbelts, undertook some measurements of vertical distribution which was closely related with their theme of research. The data obtained are reported here. Author (GRA)

N71-18459# Air Force Cambridge Research Labs., Bedford, Mass.

CONTROLLED PROCESSING OF DIRECT READOUT DATA FROM WEATHER SATELLITES

Robert F. Myers, Edward D. Sprague, and Barry A. Mareiro 22 Oct. 1970 75 p

(AD-715892; AFCRL-70-0589; AFCRL-ERP-334) Avail: NTIS CSCL 4/2

Optimization of satellite pictures by standardizing the range of reflective density is accomplished by the use of a dynamic signal simulator which sweeps the amplitude of a 2400 Hz signal from 4 to −32 dBm providing a direct display of the crater tube current versus signal amplitude on an oscilloscope. The time required for setting up the standardizing function is reduced to a few minutes per day. Use of these techniques permits quantitative temperature measurements to be made from DRIR pictures with a densitometer. Author (GRA)

N71-18529# Air Force Cambridge Research Labs., Bedford, Mass.

HIGH HUMIDITY EXTREMES IN THE UPPER AIR

D. D. Grantham and N. Sissenwine 6 Oct. 1970 23 p refs

(AD-715894; AFCRL-70-0563; AFCRL-ERP-333) Avail: NTIS CSCL 4/1

The 1- and 5-percent world-wide high dew-point envelopes from the surface to 10 km are derived statistically from operational rawinsonde data. Values at each level are based on the most extreme month at the most extreme location, as required for the revision of MIL-STD-210A, Climatic Extremes for Military Equipment. A 1-percent frost-point envelope model is extended to 80 km. It is based on limited experimental data and theory. Dew-(frost)-point envelopes and corresponding mixing ratios are tabulated to 80 km. Author (GRA)

N71-18538# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

METEOROLOGICAL TRANSACTIONS, VOLUME 98, NO. 1: SATELLITE WEATHER OBSERVATIONS AND THEIR EVALUATION. THE EUROPEAN WEATHER MAP, PART 1 Quarterly Report, 1968 [METEOROLOGISCHE ABHANDLUNGEN, BAND 98, HEFT 1: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD, TEIL 1 1. Vierteljahr, 1968]

Ingrid Haupt, Uta Kontergiannakis et al 1969 269 p refs In GERMAN; ENGLISH summary

(QR-1) Avail: NTIS

Meteorological satellite photographs, obtained in Berlin, are evaluated. Contributions to meteorological satellite observations are made and a brief review of the first decade of space research in the US is given. A new Soviet weather satellite, Cosmos 206, is described and some remarks on the snow and ice situation in Europe, the Arctic excluded, are made. ESRO

N71-18539# Ludwig-Maximilians-Universitat, Munich (West Germany). Meteorologisches Inst.

CLIMATOLOGICAL VALUES OF TEMPERATURE AND WIND STRATIFICATION IN THE LOWER 50 m OF THE ATMOSPHERE [KLIMAWERTE ZUR TEMPERATUR- UND WINDSCHICHTUNG IN DEN UNTERSTEN 50 m DER ATMOSPHAERE]

Franz Fiedler Jan. 1970 147 p refs In GERMAN *Its* Wiss. Mitt. No. 18

Avail: NTIS

Results of lower atmosphere temperature and wind stratification measurements at the meteorological station of the Munich research reactor are given. ESRO

N71-18544# Weather Wing (4th), Ent AFB, Colo.

A GLOSSARY OF AWS TERMINOLOGY

John F. Gaillard 15 Sep. 1970 57 p

(AD-715932; Rept-4WW-TP-70-4) Avail: NTIS CSCL 4/2

The paper is a descriptive glossary of terms commonly used in Air Weather Service, and is designed to provide a convenient single-source reference. Entries are generally limited to operational terms, and each entry provides a brief explanation and an authoritative reference for additional information. Author (GRA)

N71-18670# Weather Wing (4th), Detachment 4, McChord AFB, Wash.

AN OBJECTIVE METHOD FOR FORECASTING FOG AND/OR STRATUS AT PORTLAND, OREGON, SEPTEMBER–FEBRUARY

Gary G. Elkins Nov. 1970 14 p refs

(AD-715933) Avail: NTIS CSCL 4/2

The study deals with an objective method of predicting low ceilings and visibilities due to fog and/or stratus at Portland, Oregon. Author (GRA)

N71-18671# Hawaii Inst. of Geophysics, Honolulu.

THE MEAN TROPOSPHERIC CIRCULATION AND CLOUDINESS OVER SOUTHEAST ASIA AND NEIGHBORING AREAS

James C. Sapler and Barry E. Harris (AF) Aug. 1970 72 p refs
(Contract F19628-69-C-0158)
(AD-715912; HIG-70-26; AFCRL-70-0489; SR-1) Avail: NTIS CSCL 4/2

Mean monthly wind analyses for the 3,000 ft, 850 mb, 700 mb, 500 mb, 300 mb, and 200 mb levels are discussed in terms of major features and their change from month to month. The mean monthly cloudiness, compiled from five years of daily meteorological satellite data, and the change in mean cloudiness from month to month are related to the flow patterns and their changes. Longitudinal sections of monthly cloudiness and month-to-month changes in cloudiness are presented for eight selected longitudes between 70E and 140E. Author (GRA)

N71-18672# Wisconsin Univ., Madison. Space Science and Engineering Center.
A PILOT STUDY ON THE APPLICATION OF GEOSYNCHRONOUS METEOROLOGICAL SATELLITE DATA TO VERY SHORT RANGE TERMINAL FORECASTING Final Report, 1 Apr. –31 Aug. 1970
Thomas H. Vonder Waar and Richard S. Cram 30 Sep. 1970 118 p refs
(Contract F19628-70-C-0207)
(AD-715921; AFCRL-70-0493) Avail: NTIS CSCL 4/2

The study assembles a unified body of data consisting of very high space and time resolution reflected radiance measurements from a geosynchronous satellite (ATS-3) along with concurrent meteorological radar, ceiling, visibility and surface pressure reports at selected air terminals in the central United States. This data set allows familiarization with the meteorological potential of nearly continuous observation of cloud conditions from a geosynchronous platform. It may also serve as initial input to quantitative techniques for evaluating the satellite data and/or for testing its usefulness in very short range weather forecasting. In this regard, a second portion of the study presents arrays of statistical descriptors of the satellite data. Author (GRA)

N71-18673# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
THE MEASUREMENT OF SMALL SCALE VELOCITY STRUCTURE IN THE 30-60 km REGION BY THE SMOKE TRAIL METHOD Final Report, 1 Aug. 1968 –31 Aug. 1970
George J. Boer 31 Aug. 1970 65 p refs
(Contract F19628-69-C-0039)
(AD-715923; AFCRL-70-0513) Avail: NTIS CSCL 4/2

The measurement of small scale wind motions in the 30-60 km region of the atmosphere by means of the smoke trail method is described. This method obtains wind motions by photographing the deformation of a trail of smoke with time. The experiment consists of the analysis of four such trails deposited by two rockets which were fired simultaneously from different positions and which deposited a trail on both the upward and downward trajectories. The method of reduction of the photographic data to obtain the position in space of the smoke trails with time and subsequent velocities is discussed and an estimate of the error in the resulting smoothed wind profiles is obtained. The wind profiles obtained by this experiment are compared with an independent measurement which was made some 90 minutes later by a STARUTE sonde. The wind profiles are analysed in terms of the spectrum of vertical wavelengths, the phase orientation and wavelength in the horizontal and the distribution of vertical shears. A temperature profile obtained in the region is also analysed and an attempt is made to relate the wind and temperature profiles in terms of simple gravity wave theory. Author (GRA)

N71-18730# Naval Postgraduate School, Monterey, Calif.
A THREE DIMENSIONAL PRIMITIVE EQUATION MODEL FOR APPLICATION TO MESOSCALE ATMOSPHERIC PHENOMENA
Jack Trask Norton, Jr. (M.S. Thesis) Sep. 1970 58 p refs
(AD-715547) Avail: NTIS CSCL 4/2

A three dimensional primitive equation model based on the Boussinesq equations is developed and applied to the mesoscale. The model is tested with one dimensional flow in a balanced state and with two cases of gravity waves, which are forecast for 30 minutes and compared with the analytic solutions. Author (GRA)

N71-18860 Oklahoma Univ., Norman.
AN APPLICATION OF PATTERN RECOGNITION THEORY TO WEATHER PREDICTION USING QUANTIZED RADAR DATA
Jon Harold Horwedel (Ph.D.thesis) 1969 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 70-2314

An application of pattern recognition to short-term weather prediction is advanced assuming nearest-neighbor dependence and using Bayesian decision theory. The prediction scheme proposed is an easily automated procedure which is essential for real-time weather forecasting. Thus study includes a basic discussion of radar meteorology and its influence upon the data form used for prediction. The original data were taken in polar form and represented intensity categories of the radar reflectivity factor, which can be used as a measure of severity. A procedure is presented for changing the data form from a polar scan to a rectangular pattern. Also a reduction of the seven intensity categories, forming three intensity classes, is proposed for decreasing the size of the needed prediction machine. The rectangular patterns are divided into subpatterns. These subdivisions form the fundamental unit of the prediction plan. Optimum decision theory is incorporated with basic weather assumptions to form the primary prediction method. Several methods of estimating the probabilities used for prediction are included with the primary prediction method to form three prediction schemes. Dissert. Abstr.

N71-18998# National Center for Atmospheric Research, Boulder, Colo. Lab. of Atmospheric Science.
DESCRIPTION OF NCAR GLOBAL CIRCULATION MODEL
Joseph E. Oliger, Robert E. Wellck, Akira Kasahara, and Warren M. Washington May 1970 98 p refs Sponsored by NSF
Avail: Issuing Activity

The basic equations, physical processes, and finite difference equations of a global circulation model are described. The code is writeen in a modular fashion; that is, the various atmospheric processes in the code are separated so that they can be changed to test the formulation of various physics. Author

N71-18999 St. Louis Univ., Mo.
THE MECHANICS OF MOTION OF GREAT PLAINS THUNDERSTORMS
Thomas Darryl Madigan (Ph.D. Thesis) 1969 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-1856

The three dimensional geometry of thunderstorms is generated by use of a model. This can only be done when the storm motion is known. This technique is explanatory rather than predictive. The structure of the storm below the anvil is then divided into separate circular cylinders, each 1000 ft. in height. The wake divergence is mapped behind each cylinder. The pressure tendency contribution is determined for each layer at each of 24 grid points. In this manner the portion of the surface isallobaric field due to wake divergence is mapped. This field is modified by subsidence through the base of the anvil into the wake divergence region, and the motion is explained. Dissert. Abstr.

N71-19046# National Oceanic and Atmospheric Administration, Silver Spring, Md. Techniques Development Lab.
OBJECTIVELY COMPUTED SURFACE DIAGNOSTIC FIELDS
Robert J. Bermowitz Feb. 1971 27 p refs
(NOAA-TM-NWS-TDL-38) Avail: Issuing Activity

Hourly surface observations of temperature and wind are objectively analyzed on a grid with a gridlength of about 50 miles (1/4 that used at the National Meteorological Center). The analyses are used to compute relatively small-scale diagnostic fields of divergence, vorticity, frontogenetical function, and temperature advection. The results of two test cases are described. It appears that the diagnostic fields can be helpful in short range predictions. In some cases, they seem to be related to significant smaller scale features such as regions of thunderstorm and tornado activity and incipient cyclogenesis. Synoptic scale features such as frontal zones appear to be rather well represented by the diagnostic fields. Author

N71-19159# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPERATURE, PRESSURE, DENSITY, AND WIND MEASUREMENTS IN THE STRATOSPHERE AND MESOSPHERE, 1969
W. S. Smith, J. S. Theon, J. F. Casey (Globe Universal Sciences), A. Azcarrage (Inst. Nacional de Technica Aeroespacial), and J. J. Horvath (Mich. Univ., Ann Arbor) Washington Mar. 1971 53 p refs
(NASA-TR-R-360; G-1005) Avail: NTIS CSCL 04B

Complete data from a total of 23 rocket soundings conducted from Arenosilli, Spain; Barrow, Alaska; Churchill, Canada; and Wallops Island, Virginia are presented. Temperature, pressure, density, and wind profiles from 21 acoustic grenade experiments covering the altitude range of approximately 30 to 90 km are tabulated. No attempt has been made here to analyze the meteorological significance of these data. Errors for each of the 21 grenade soundings have been computed and are included. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-18187*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A SUMMARY OF AVAILABILITY AND ACCURACY OF LANDING AIDS FOR SHUTTLE APPLICATIONS
Richard J. Labrecque 14 Aug. 1970 6 p refs
(NASA-TM-X-66720; MSC-70-FM22-137) Avail: NTIS CSCL 17G

Observations on landing the shuttlecraft and navigational aid capabilities are summarized. Findings show that if emergency landings at almost any airport are attempted some of the current navigational aids should be included in the shuttle equipment. There are a variety of navigational aids available accurate enough to vector the shuttle to the landing area and perform a guided approach. There is no system however that has demonstrated guided landings at the large glide angles in unpowered shuttle landings. A transponder type RR set right at the landing site could help vector the shuttle in an emergency or serve to update the inertial system. Author

N71-18299# Army Foreign Science and Technology Center, Washington, D.C.
PRINCIPLES OF RADIO NAVIGATION
O. V. Belavin 26 Oct. 1970 409 p refs Transl. into ENGLISH of the book 'Osnovy Radionavigatsii' Moscow, Sovetskoye Radio Publishing House, 1967 470 p
(AD-714829; FSTC-HT-23-381-70) Avail: NTIS HC $8.00/MF $0.95 CSCL 17/7

The textbook for radio engineering higher institutions of learning and departments explains the operating principles of radio navigational aids used to navigate flying vehicles. General questions concerned with the accuracy of navigational fixes obtained near the earth, as well as in cosmic space, are reviewed. Attention is focused on amplitude, phase, frequency and time radio navigation measurements. An analysis is made of the errors occuring in radio navigational aids resulting from the use of other than modern equipment, from the effect of the conditions under which radio waves are propagated, and from the effect of natural and organized radio interference. GRA

N71-18355# Coast Guard, Washington, D.C. Applied Technology Div.
VALUATION OF LS-59 XENON FLASHTUBE BEACON Final Report
J. Terrence Montonye and Guy P. Clark 2 Dec. 1970 128 p refs
(AD-715872) Avail: NTIS CSCL 17/7

Condenser-discharge beacons capable of operation from battery power supplies on buoys and minor lights offer four distinct advantages over incandescent beacons: increased servicing periods, increased battery life, increased visual effectiveness, and increased glow ranges in fog. The report presents the laboratory and field test results of the LS-59 flashtube beacon, as well as a discussion of the potential use of condenser-discharge burst lights as a future base for a maritime signal lighting system. Author (GRA)

N71-18525# Air Force Academy, Colo. Frank T. Seiler Research Lab.
A NEW GYROSCOPE CENTRIFUGE TEST
Dino A. Lorenzini Dec. 1970 23 p refs
(AD-715906; SRL-TR-70-0018) Avail: NTIS CSCL 17/7

A new approach is proposed for the evaluation of a gyroscope on a precision centrifuge using a counter-rotating platform (CRP) on which a precison rate table is mounted. This method permits an independent solution to be obtained for the gyro error model coefficients every eight seconds. In this way, the short-term characteristics of the individual drift coefficients can be studied. The higher input acceleration levels provided by the centrifuge gives better coefficient recovery and allows an investigation of their linearity. An analysis of the potential error sources indicates that the gyro alignment, rate table drive accuracy, torque loop frequency response and synchronous CRP operation are important considerations. Extensive gyro and centrifuge instrumentation is required to adequately measure the test environment and to verify or modify the analytical models. Suggested further studies and hardware evaluation tasks are outlined and recommended as follow-on efforts to insure the successful implementation of the novel test procedure. Author (GRA)

N71-18564# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL INTEGRATION OF THE LAWDEN INTERMEDIATE THRUST ARCS AND THEIR OPTIMALITY IN A NEWTONIAN CENTRAL FORCE FIELD [INTEGRATION NUMERIQUE DES ARCS A POUSSEE INTERMEDIAIRE DE LAWDEN ET ETUDE DE LEUR OPTIMALITE (DANS UN CHAMP NEWTONIEN CENTRAL)]
Anibal Archenti and Christian Marchal 1970 17 p refs In FRENCH; ENGLISH summary Presented at the Congr. Intern. d'Astronautique, Constance, West Ger., 4–10 Oct. 1970 Submitted for publication

(ONERA-TP-869) Avail: NTIS

Intermediate thrust arcs satisfy the necessary optimal conditions but are seldom really optimal. The supplementary condition is thrust must be always directed below the local horizontal plane. In the plane case, easily integrable numerically, the intermediate thrust arcs constitute a one-parameter family, from the spiral to the reversible arc. These arcs are studied in detail and are optimal on sufficiently short lengths. The study of the total optimization is difficult but, in the case of the reversible arc however, various comparisons, such as the comparison with the one-impulse transfer of the same duration, indicate that the favourable part of the reversible arc is optimal in totality. Some examples of numerically integrated arcs are presented in symmetrical and non-symmetrical cases, and also in cases with a zero or a non-zero Hamiltonian.
Author (ESRO)

N71-18761*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A TECHNIQUE FOR EVALUATING PARAMETER VARIATIONS FOR AUTOMATICALLY CONTROLLED AIRCRAFT WITH AN APPLICATION TO THE LANDING APPROACH

Stuart C. Brown and Homer Q. Lee Washington Mar. 1971 46 p refs

(NASA-TN-D-6230; A-3244) Avail: NTIS CSCL 01C

A method involving the minimization of a performance criterion was used to analyze the ability of automatically controlled aircraft to maintain accurate flight-path control during the landing approach. The criterion was based primarily on the ability of the aircraft to follow a constant slope glide path in the presence of statistically described gust disturbances. Constraints on the adjustments of the linear control system parameters were included as part of the method. The method was implemented by means of a digital computer to perform the parameter search required for the minimization of the performance index. The utility of the method was evaluated by determining effects of variations in several aircraft parameters on the control of longitudinal motions of a subsonic and a supersonic jet transport aircraft.
Author

N71-19000# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences Section.

AN ANALYSIS OF TWO ALTERNATE ESTIMATION SCHEMES FOR MEASURING GYROSCOPIC DRIFT OF THE E-2C AIRCRAFT INERTIAL NAVIGATION SYSTEM

Richard Gran Feb. 1971 41 p refs

(RM-495) Avail: NTIS

A technique for analyzing systems that are hybrid and for which it is desired to determine the nonstationary statistics is described. The particular application that prompted this investigation is a problem that arose in the analysis of two estimation algorithms to determine the drift of a gyroscope in an inertial navigation system. In this case, the gyro loop is continuous, whereas the estimation is a discrete system. The desired result is a comparison of two different schemes for estimating the drift. While this application is very specific, the technique is applicable to a wide range of system problems. In particular, similar problems have arisen in the past in such diverse areas as control systems analysis and in the determination of errors that arise in digital integration schemes.
Author

N71-19044*# Auburn Univ., Ala. Engineering Experiment Station.

ON ERROR BOUNDS IN THE DIGITAL COMPUTATION OF THE FOUR PARAMETERS FOR STRAPDOWN INERTIAL SYSTEMS

Joseph S. Boland, III 14 Dec. 1970 101 p refs

(Contract NAS8-20104)

(NASA-CR-103050; TR-24) Avail: NTIS CSCL 17G

A numerical integration scheme for solving the four parameter vector differential equation is derived and investigated. The results obtained can be applied to a large class of numerical integration schemes, since this class can be shown to be equivalent to the derived scheme. Bounds for the truncation errors and roundoff errors generated by the digital computer in computing the four parameters using the derived scheme are developed. Study shows that the resulting error bounds are useful in the determination of an optimal integration scheme and sensor sample rate for a particular mission using a given computer.
Author

N71-19045*# Auburn Univ., Ala. Engineering Experiment Station.

[STUDIES OF THRUST VECTOR CONTROL OF LARGE SPACE VEHICLES] Final Report

Joseph S. Boland, III 14 Dec. 1970 25 p refs

(Contract NAS8-20104)

(NASA-CR-103049) Avail: NTIS CSCL 17G

The results of several research projects concerning spacecraft operation are presented. Subjects discussed are: (1) display devices, (2) fluid amplification techniques, (3) stochastic processes, (4) thrust vector control systems, (5) optimal control, (6) vehicle guidance, (7) missile attitude control, and (8) momentum exchange control devices.
Author

N71-19212* Raytheon Co., Sudbury, Mass.

LASER DOPPLER SYSTEM FOR MEASURING THREE DIMENSIONAL VECTOR VELOCITY Patent

Edward Rolf, Kenneth F. Kinnard, and Robert M. Huffaker, inventors (to NASA) Issued 6 Oct. 1970 (Filed 22 Apr. 1969) 3 p Cl. 356-28; Int. Cl. G01p5/00 Sponsored by NASA

(NASA-Case-MFS-20386; US-Patent-3,532,427; US-Patent-Appl-SN-818349) Avail: US Patent Office CSCL 17G

A laser Doppler velocimeter for measuring the mean velocity and turbulence of a fluid flow is described. Optical homodyning of a portion of a laser beam scattered from moving particles embedded in a flowing fluid with a portion of the laser beam is made from three different viewing angles to produce beat signals at the frequency of the Doppler shift due to the motion of the fluid. The Doppler shift signal containing the mean velocity and turbulence information is frequency demodulated to produce a fluctuating dc output. The dc output corresponds to a carrier frequency or mean velocity of the fluid and a time-dependent random signal corresponding to the turbulent fluctuations in the fluid flow.
Official Gazette of the U.S. Patent Office

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-18169# Japan Atomic Energy Research Inst., Tokai.

JAERI FAST REACTOR GROUP CONSTANTS SYSTEMS, PART 1

Satoru Katsuragi, Tatsuzo Tone, and Akira Hasegawa Feb. 1970 140 p refs

(JAERI-1195-Pt-1) Avail: AEC Depository Libraries

A concept of fast group constants was studied and a processing program was developed using the ENDF/A format. Evaluation was performed from the standpoint of reactor physics to find better interpretations of nuclear data for producing group

constants. Three filed, UKNDL, ENDF/B and KFK 120 (1, 2, 3 and KFK 750) were compared with each other. A set of appropriate nuclear data was obtained. Using the processing program and nuclear data, group constants were produced for the following elements: B-10, B-11, C, O, Na, Al, Cr, Fe, Ni, Cu U-235, U-238, Pu-239, Pu-240 and Pu-241. The following quantities are prepared for users: 70-group cross section tables and 25-group cross section tables for infinite dilution, inelastic scattering matrices, 70-group fluxes for several values of admixture cross section and tables of self shielding factor. NSA

N71-18170# Kernforschungszentrum, Karlsruhe (West Germany). Inst. Fuer Angewandte Reaktorphysik.

DIRECTLY ELECTRICALLY HEATED UO2 FUEL ROD

D. Freund and W. Schikarski [1970] 53 p refs Transl. into ENGLISH from German report KFK-1031 Sponsored in part by US/Euratom

(EURFNR-773) Avail: NTIS

The method reported allows heating of sintered UO-2-rods by direct electric current without an internal axial metallic resistance heater. The temperature distribution of a direct electrically heated UO2-rod is calculated by means of a digital computer program based on radial power balance. The comparison between the direct electrically heated rod and the nuclear reactor fuel rod shows that a good simulation of the nuclear fuel temperature distribution can be achieved. Experimental and measuring devices are described. The stationary electrical heating of the UO2-pin with electrical energy requires a power controlled circuit. The dynamic conditions are simulated by a pulsed current taken from a bank of capacitors. The method permits investigations on the thermal and thermodynamic behavior of UO2-fuel pins. Performance of UO2-pins under dynamic conditions depending only on thermal influences are investigated. A partial simulation of pin failure and of nuclear reactor excursions with well defined parameters are described. Preliminary results with sintered UO2-pins are reported. Author (NSA)

N71-18171# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.

THORIUM DIFFUSION IN THORIA AND URANIA

A. D. King Aug. 1970 50 p refs

(AECL-3655) Avail: AEC Depository Libraries; Atomic Energy Can., Ltd. Chalk River $1.50

Techniques are described for the measurement of Th-228 diffusion in ThO2 and UO2. Results are presented for single crystal ThO2 in the range 1850 to 2000 C and single crystal UO2 at 1575 C. The diffusion profiles are interpreted in terms of lattice and dislocation diffusion coefficients. Previous data on cation diffusion in ThO2 and UO2 are discussed. Author (NSA)

N71-18174# Scientific Research Atomic Reactor Inst., Melekess (USSR).

THE INVESTIGATION OF RADIATION ENERGY RELEASES IN THE EXPERIMENTAL CHANNELS OF THE SM-2 REACTOR

A. P. Veselkin, V. A. Neverov, A. P. Fomenko, V. A. Tsykanov, and O. L. Shchipakin 1970 33 p refs In RUSSIAN

(SRARI-P-69) Avail: AEC Depository Libraries

The experimental values of radiation energy releases in specimens placed into SM-2 reactor channels are compared with calculated ones obtained with Gamma-2 program realizing Monte Carlo method. As a result of the calculation technique which simulates the actual arrangement of SM-2 reactor channels satisfactorily, agreement is obtained between experiment and calculation. Author (NSA)

N71-18176# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

STATISTICAL WEIGHT FACTOR FOR CALCULATING XENON EFFECT ON REACTIVITY IN EQUILIBRIUM CONDITIONS

G. Casini and J. Pillon [1970] 19 p Transl. into ENGLISH from Italian Report EUR-102

(LIB/TRANS-303) Avail: AEC Depository Libraries

A quick method to calculate the Xenon poisoning in the reactor design is shown. By defining a statistical weight factor G, it is possible to evaluate the reactor poisoning by the calculation of the poisoning in one point. Plots of the G factor as a function of the geometrical and flux parameters are given for a cylindrical reactor with a flattened central region. Author (NSA)

N71-18177# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.

TEST EQUIPMENT DESIGN FOR DIRECT DETERMINATION OF FISSION ENERGY DISTRIBUTION IN A FUEL ELEMENT OF THE FIRST CZECHOSLOVAK NUCLEAR POWER PLANT

J. Kott, V. Jirousek, and S. Teren 1970 10 p refs

(ZJE-88) Avail: AEC Depository Libraries

A direct method for measuring the heat generation in the U fuel pin for Bohunice Power Reactor Unit 1 is described. For verification of this method a special calorimetric sound test was designed. The calorimetric probe construction is described. Author (NSA)

N71-18178# Argonne National Lab., Ill.

SODIUM TECHNOLOGY Quarterly Report, Apr.–Jun. 1970

G. M. Kesser, comp. Sep. 1970 77 p refs

(Contract W-31-109-eng-38)

(ANL-ST-3) Avail: NTIS

Efforts devoted to initiation of a national meter program to characterize on-line instrumentation for monitoring oxygen, carbon, and hydrogen in sodium, for detecting leaks in steam generators, and to establish the commercial availability of such meters built to RDT standards are summarized. Implementation of a program to formulate standard analytical methods that meet the needs of the national sodium technology program, and development of methods for determining oxygen, carbon, nitrogen, and trace metals in sodium and radioisotopes in cover gases are described. Definition of problems created by radioactivity in primary sodium and cover gases, development of methods for detecting and characterizing fuel failures, and investigation of methods for measuring sodium aerosol in cover gases are reported. Development of methods for purifying primary coolant sodium, studies of the transport of carbon in sodium-steel systems, and evaluation of vanadium alloys as cladding for LMFBR fuels are described. Author (NSA)

N71-18197# Nuclear Materials and Equipment Corp., Apollo, Pa.

SPECTROGRAPHIC ANALYSIS RESPONSE OF A CARRIER TO PLUTONIUM-URANIUM MIXED OXIDES

A. J. Murray, J. L. Marley, and J. E. Scott 2 Nov. 1970 21 p

(Contract AT(30-1)-3524)

(NUMEC-3524-76) Avail: NTIS

A study was made of the spectrographic analysis of plutonium-uranium mixed oxides. A silver chloride - barium fluoride-graphite carrier was used. Significant changes in spectral line intensity for the same element concentration levels were demonstrated, among the elements studied, as the plutonium oxide to uranium oxide ratio was changed. Author (NSA)

N71-18208# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

SPATIOTEMPORAL STUDY OF A GRAPHITE GAS POWER REACTOR [ETUDE SPATIO-TEMPORELLE D'UN REACTEUR DE PUISSANCE A GRAPHITE-GAZ]

N. Teillier, P. Roux, and M. Deat 1970 13 p refs In FRENCH Presented at Conf. on Hybrid Computation, Munich, 31 Aug.–4 Sep. 1970

(CEA-CONF-1580; CONF-700828-3) Avail: AEC Depository Libraries

The different stages of a spatiotemporal simulation of a nuclear reactor made on a hybrid computer are described. The purpose of this simulation is the evaluation of the performances of a EAI 9800 type hybrid computer in the resolution of an important system of partial differential equations. The results were compared with those obtained from a digital code resolving the same equations s on a CDC 6600 computer. NSA

N71-18209# Forskningradens Lab., Studsuik (Sweden).

ELECTRON SPIN RESONANCE STUDIES ON IRRADIATED HETEROGENEOUS SYSTEMS 6: THE STRUCTURE AND REACTIVITY OF PARAMAGNETIC CENTERS IN SILICA GEL

Per-Olof Kinell, Tsuyoshi Komatsu, Anders Lund, Tetsuo Shiga, and Akira Shimizu 1970 32 p refs

(NP-18478; LF-29) Avail: AEC Depository Libraries

The paramagnetic centers formed in silica gel gamma-irradiated at 77 K were identified from ESR spectra, microwave saturation behavior, optical and thermal bleaching properties, and influence of various gel pretreatments. Four main centers are formed, namely electrons trapped at oxygen vacancy sites at g = 2.0008, electrons trapped at a limited number of sites, whose nature is not at present quite clear at g = 2.0030, hole centers trapped on the surface of the silica gel and located near to nonbridging oxygen atoms at g = 2.0070, and finally centers attributed to holes located close to Al-27 nuclei at g = 2.011. The centers react with oxygen at 77 K during several months storage. Except for electron transfer reactions, hole transfers also occur as indicated by cation radical formation in adsorbate molecules and simultaneous quenching of the g = 2.0070 hole centers. Author (NSA)

N71-18210# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

STUDY OF U-Pu-Cm CARBICES [ETUDE DE CARBURES U-Pu-C-M]

Shimon Bocker, Rene Boucher, Robert Lorenzelli, and Claude Milet 1970 9 p refs In FRENCH Presented at 4th Intern. Conf. on Plutonium and other Actinides, Santa Fe, N.Mex., 5–9 Oct. 1970

(CEA-CONF-1632; CONF-701001-11) Avail: AEC Depository Libraries

Additions were made to U-Pu-C in an attempt to improve the properties and facilitate the manufacture of this type of fuel by eliminating the phases (U-Pu)C2 and (U,Pu)2C3. The systems U-Pu-C-Zr, U-Pu-C-Ti and U-Pu-C-Mo with small additions (approximately 3 at.%) of the element M and a ratio Pu/U + Pu equal to 20 or 25% were investigated. Two manufacturing processes were studied. The thermal conductivity, deduced from thermal diffusivity measurements between 20 and 1500 C, is considerably improved with respect to sintered U-Pu-C in the case of carbides alloyed with Mo (cast or sintered), Ti and Zr (cast); the thermal conductivity remains about the same in the case of sintered carbides alloyed with Zr. The thermal expansion coefficients measured between 20 and 1500 C are very similar to those of U-Pu-C. Resistance to atmospheric corrosion at 25 C is better than that of cast U-Pu-C for the three systems studied. Author (NSA)

N71-18211# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

SOLUBILITY OF INERT GASES IN SODIUM REACTOR COOLANT AND ATTENDANT SAFETY ASPECTS [DIE LOESLICHKEIT VON EDELGASEN IM REAKTORKUEHLMITTEL NATURIUM UND SICH DARAUS ERGEBENDE SICHERHEITSASPEKTE]

K. Thormeier May. 1970 100 p refs In GERMAN; ENGLISH summary

(KFK-1166) Avail: AEC Depository Libraries

The investigation covers a wide range of temperatures and pressures. Calculation of the solubilities of inert gases in sodium is made on the basis of the model concept that a dissolved gas atom requires a hole of its size in the liquid and that the gas atom, once it is placed in that hole, interacts with the ambient liquid and is made to vibrate. For experimental verification of these results a novel method has been developed for measurement of the solubility of gases in liquids which is suitable especially for determining the solubility of inert gases in liquid metals. The measured results, which are well reproducible, are in good agreement with the values derived theoretically. On the basis of the solubility data thus obtained the significance to safety of the cover gas bubbles (argon and helium, respectively) produced in the sodium as a result of temperature changes and the capacity for the fission gases krypton and xenon in sodium are regarded for the primary circuit of the fast sodium-cooled breeder reactor SNR. Author (NSA)

N71-18213# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).

CHEMICAL ASPECTS OF REACTOR SAFETY (LITERATURE REVIEW). 4: REPORT IN THE MISSION OF THE FEDERAL MINISTRY FOR DEVELOPMENT AND SCIENCE [CHEMISCHE ASPEKTE DER REAKTORSICHERHEIT (LITERATUREUEBERSCICHT). 4: BERICHT IN AUFTRAG DES BUNDESMINISTERIUMS FUER BILDUNG UND WISSENSCHAFT]

E. Hoinkis Jul. 1970 85 p refs In GERMAN; ENGLISH summary

(HMI-B-99) Avail: AEC Depository Libraries

Chemical aspects of safety are discussed under the general areas of: release and transport of fission products; aerosol behavior; chemical reactions of metal cladding; oxidation of graphite and coated particles; chemical reactions of fuel; adsorption of fission products on metals and graphite; fission product transport in gas cooled reactors; chemical problems of sodium loops; and corrosion in water cooled reactors. NSA

N71-18214# European Atomic Energy Community, Petten (Netherlands). Joint Nuclear Research Center.

URANIUM DISTRIBUTION AND URANIUM DIFFUSION THROUGH THE PYROCARBON COATING IN UO2 COATED PARTICLES

G. Busca, A. Drago, P. Fenici, and W. Huber 15 Apr. 1970 16 p refs

(EUR-4530) Avail: AEC Depository Libraries

The uranium diffusion through the pyrocarbon coating of a UO2 kernel was studied in the temperature range of 1600 to 1900 C. The experimental data fit an equation of the form D = 47,700 exp (– 86000/RT). The uranium distribution through the coating has been evaluated by means of a micro-grinding technique carried out in the laboratory. A uniform distribution of uranium through the coating except for the buffer layer has been observed. Both experimental results indicate that the uranium diffusion for the range of temperature and type of coated fuel particles considered, is controlled by the kernel composition. Author (NSA)

N71-18215# Reactor Centrum Nederland, Petten.

FAST REACTOR PROGRAM Quarterly Progress Report, Oct.–Dec. 1969

E. K. Hoekstra, comp. Jul. 1970 116 p refs

(EURFNR-822; RCN-120; QPR-4) Avail: AEC Depository Libraries

The RCN program comprises reactor physics, fuel performance, radiation damage in canning materials, corrosion behavior in canning materials, aerosol research, heat transfer, and hydraulics. Author (NSA)

N71-18216# Institute of Nuclear Research, Warsaw (Poland).

POLISH-ITALIAN SEMINAR ON SOME CHEMICAL, CERAMIC, AND METALLURGICAL ASPECTS OF NUCLEAR FUELS: SUMMARIES

1970 34 p Conf. held at Zakopane, Poland, 29 May – 2 Jun. 1970

(INR-1194; CONF-700540) Avail: AEC Depository Libraries

Summaries of 46 papers are presented on processing fuels including analytical methods, separation processes, fuel fabrication processes, and fission product behavior. NSA

N71-18221# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

FINE STRUCTURE, HYPERFINE WEIGHTS, AND REACTIVITY WORTHS IN A HARTLEPOOL AGR CLUSTER

D. L. Nunn May 1970 36 p refs Submitted for publication

(RD/B/N-1724) Avail: AEC Depository Libraries

The fine structure, the hyperfine weights, and the reactivity in a Hartlepool A. G. R. fuel cluster at operating temperatures, with and without burnable poisons present, are calculated by the PRIZE theoretical method for two fuel enrichments and a comparison is made with other theoretical methods, i.e., TWODIG, CALIF, ARGOSY and WIMS. Author (NSA)

N71-18228# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

FACTORS INFLUENCING THE STRENGTH OF COMPOSITE FUEL BODIES

J. P. Ashford May 1970 42 p refs Presented at 3d Conf. on Ind. Carbons and Graphite, London, 1970 Submitted for publication

(RD/B/N-1622) Avail: AEC Depository Libraries

The factors influencing the strength and elastic behavior of composite fuel bodies are reviewed and the importance of micromechanical stresses caused by different elastic properties of the separate phases are discussed. Fracture studies on 4 point bending beams are used to assess strength and elastic properties of composite fuel bodies with volumetric loading of zero, 20%, and 35% of UO2 microspherical coated particles. The integrity of the coated particle fuel does not appear to be influenced by the crack propagation through the matrix. Author (NSA)

N71-18229# Kernforschungszentrum, Karlsruhe (West Germany). Inst. Fuer Reaktorentwicklung.

EXPERIMENTAL THERMAL SHOCK ANALYSIS

W. Lang May 1970 94 p refs In GERMAN

(KFK-1168) Avail: AEC Depository Libraries

A method of solving problems related to transient thermal stresses is described. The method is based on the experimental determination of frequency response functions and weighting functions for thermal stresses. With the use of Duhamel's integral, the method determines the time curves of the temperatures and thermal stresses generated in a structural component as a result of fast variations of the coolant temperature during reactor operation. Moreover, it provides the means to evaluate the effects of cyclic thermal loads encountered in reactor operation which may cause fatigue of the structure in long-term operation. A representative structural component of reactor technology (hollow cylinder of 100 mm inside diameter with an abrupt change of wall thickness from 20 mm to 2 mm), which is particularly sensitive to thermal stresses, was equipped with thermocouples and strain gages and investigated in a helium circuit, in order to test the proposed method. The validity of the method was demonstrated. Author (NSA)

N71-18234# Japan Atomic Energy Research Inst., Tokyo.

STUDY FOR DECAY CHAIN OF FISSION PRODUCTS. REPORT OF THE FISSION PRODUCTS WORKING GROUP, NO. 1

Hajime Sakata, Satoshi Nagayama, and Iwao Otake Apr. 1970 49 p refs In JAPANESE; ENGLISH summary

(JAERI-1194) Avail: AEC Depository Libraries

Concerning the burnup analysis in a thermal reactor system, the multi-group constants of the fission products (FPs) have been studied on the following items: (1) nuclear data of FPs, such as thermal fission yield, decay constant, thermal neutron absorption cross section, and resonance integrals (2) decay chain of FPs nuclides; (3) production of the calculation code, FP CHAIN, for the decay chain analysis; and (4) buildup amounts of FPs at given exposure stages. Based on the results of the present chain calculations with about 300 fission product nuclides, production of the multi-group constants for the pseudo fission products should be performed in the next step of investigation. Author (NSA)

N71-18237# Central Research Inst. for Physics, Budapest (Hungary).

SISYPHUS: A CODE FOR THE SOLUTION OF FEW-GROUP DIFFUSION EQUATIONS IN TWO DIMENSIONS

Z. Szatmary and J. Vigassy [1969] 13 p

(KFKI-70-13-RPT) Avail: AEC Depository Libraries

A computer code which solves the few-group diffusion equation in two-dimensional (X – Y and R – Z) geometries using the method of finite differences is described. This is a criticality code for the determination of the smallest eigenvalue (lambda = 1/k sub eff) and the corresponding eigenfunction. As a by-product of the solution of the diffusion equation, the code calculates various reaction rates in the reactor. Several options are available to the user, including type of boundary condition and possible symmetry properties. The SISYPHUS is an ICL-1905 code which requires at least a paper tape reader and line printer. Additional peripherals which may be required (depending on the complexity of the problem considered) are a second paper tape reader, a paper tape punch, and up to three scratch magnetic tapes. NSA

N71-18257# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

LIQUID SODIUM IN A SINUSOIDAL PRESSURE FIELD INCLUDING GAS EFFECTS

F. G. Hammitt Oct. 1970 27 p refs

(Grants NSF GK-1889; MMPP-406)

(PB-195426; UMICH-01357-18-T; MMPP-406-1-T) Avail: NTIS CSCL 18I

The possible influence of inert gas within the liquid on nucleation in a sodium-argon system under a sinusoidal pressure wave of selected frequencies (14.5 to 24.5 kHz) was investigated. The system consists of a beaker of molten sodium below an argon blanket into which is inserted a 'vibratory horn' of the type commonly used for the study of cavitation. The results show that, even though gas-in-liquid solubilities are very low compared to air-water systems, there is adequate dissolved gas to provide a large number of suitably-sized nuclei within the critical region. However, there is no mechanism for the transfer of this dissolved gas to the entrained microbubbles necessary for nucleation, except through rectified diffusion, which is shown to be possible only at very high temperatures (approx. 1000 F). The nuclei required to justify the observed threshold values must be entrained from the free surface, or introduced as unwetted solid impurities in the filing process. Author (GRA)

N71-18250# Battelle-Northwest, Richland, Wash.
U 235 DEPLETION AS A POTENTIAL INDEPENDENT CROSS-CHECK OF THE PLUTONIUM CONTENT OF SPENT POWER REACTOR FUELS
R. A. Schneider, D. E. Christensen, and D. P. Granquist 28 May 1970 20 p refs Presented at the 11th Ann. Meeting of Inst. of Nucl. Materials Management, Gatlinburg, Tenn., 25–27 May 1970
(Contract AT(45-1)-1830)
(BNWL-SA-3304; CONF-700541-1) Avail: NTIS

Small and gross material sample data for the Yankee reactor spent fuel were evaluated in a search for relations which would provide an independent cross-check of Pu content. The relation of U-235 depletion versus Pu content was examined. It was found that a linear function fits the data. The data are used to establish a technique applicable to individual input batches or the input to an entire campaign when a core of a single or uniform initial enrichment is being processed. It is also applicable to the entire input when the core is of various initial enrichments. NSA

N71-18270# Japan Atomic Energy Research Inst., Tokyo.
THE CALIBRATION TECHNIQUE AND THE NEUTRON EXPOSURE CHARACTERISTICS OF THE JPDR IN-CORE MONITOR SYSTEM
M. Kawasaki, T. Nakumura, and T. Tanaka Aug. 1970 32 p In JAPANESE; ENGLISH summary
(JAERI-4114) Avail: AEC Depository Libraries

The calibration technique of the JPDR in-core monitor system and its neutron exposure characteristics which could be obtained from the calibration data during the JPDR operation from October 1963 to September 1969 are described. The data reveal that the neutron sensitivity of each monitor dropped rapidly at the beginning of service, and subsequent to this, fell gradually as the neutron exposure increased. They also show that each falling slope of the neutron sensitivity varies with the monitor and is steeper than that expected from the burnup of the neutron-reacting-material of the monitor. Author (NSA)

N71-18271# Technische Hochschule Munchen (West Germany). Inst. fuer Messund Regelungstechnik.
COMPARISON OF THE SURVIVAL PROBABILITY OF REACTOR SAFETY SYSTEMS WITHOUT CONSIDERATION OF REPAIRS [EIN VERGLEICH DER UEBERLEBENSCHEINLICHKEIT VON REAKTORSICHERHEITSSYSTEMEN OHNE BERUECKSICHTIGUNG DER REPARATUR]
H. Gieseler Dec. 1969 15 p refs In GERMAN
(MRR-57) Avail: AEC Depository Libraries

By means of probability calculation and Boolean algebra, various reactor safety systems were analyzed. Computations were based on the following conditions: no difference was made between dangerous and insignificant failures; at time zero, all systems are 100% dependable; repairs were not considered; failure rate of the same structural components were equal; for electronic instruments and components, an exponential failure distribution was assumed; for mechanical components, normal failure distribution was accepted; and the monitoring devices in each channel were equal in construction but independent of each other. The first system was designed for a pressurized water reactor, the second for a boiling water reactor, and the third operated in a gas-cooled reactor for several years. Safety factors for the three systems are compiled and methods for improvement are proposed. NSA

N71-18288# Societa Ricerche Impianti Nucleari, Saluggia (Italy).
STUDY OF THE NEUTRON STREAMING THROUGH CYLINDRICAL DUCTS WITH TWO BENDS IN WATER: EXPERIMENTS Final Report
B. Chinaglia, G. Bosio, and D. Monti 17 Apr. 1970 62 p refs
(Contract EURATOM-077-66-1-TEEI)
(EUR-4498) Avail: AEC Depository Libraries

Neutron streaming through cylindrical bent ducts in water has been studied with a set of experiments in which both the angle and the diameter have been changed (four values for the angle from 15 to 90 deg and two values for the diameters 15 and 30 cm). Reaction rates for threshold neutron detectors and thermal and epithermal flux are presented in tables and graphs. Author (NSA)

N71-18293# Gulf General Atomic, San Diego, Calif.
HTGR FUEL REPROCESSING: HEAD-END TREATMENT OF EXPERIMENTAL SMALL-SCALE HTGR FUEL ELEMENTS, PART 2
L. H. Brooks 13 Oct. 1970 31 p refs
(Contract AT(04-3)-167)
(GAMD-9260-PT-2) Avail: NTIS

Research and development work on the grind-burn-leach process continued. A jaw crusher was built for crushing 12-rod fuel elements. Experiments indicated that a jaw crusher breaks the fuel to an acceptable size range without breaking an unacceptable fraction of fuel particles. Tumbling and screening was shown to be a good method of separating the crushed material into two streams: a graphite-rich and a fuel particle-rich stream. This operation allows the utilization of two fluidized bed burners, a large one for graphite and a smaller one for fuel particles. Tumbling is fast and easy, but trials on irradiated fuels must be carried out before final conclusions can be drawn. Burning was carried out in fluidized beds. All types of fuel and graphite were tested and present no insoluble difficulties. Leaching trials were carried out in a 1-liter leacher. Burned BISO and ground, burned TRISO fuel particles were successfully leached. Author (NSA)

N71-18325# Battelle-Northwest, Richland, Wash.
MODIFICATIONS OF A TRIODE SPUTTERING UNIT TO PROVIDE MAXIMUM FLEXIBILITY FOR USE IN A RADIOACTIVE GLOVE BOX ENVIRONMENT
W. J. Coleman [1970] 22 p
(Contract AT(45-1)-1830)
(BNWL-SA-3609; CONF-701011-2) Avail: NTIS

In the development of a method to contain polonium as an isotopic heat source the hollow microsphere concept was originated. The process of modification and installation of a sputtering system for deposition of a protective coating onto microsphere heat sources is described. To make the heat source work many new fabrication processes were required. Deposition of activation layer (or direct deposition of alpha emitter) and deposition of compatibility cladding in this process involves sputtering and vacuum evaporation techniques. The process described is the modification and installation of a sputtering system to deposit a protective coating over the 150 micron diameter fueled microsphere in preparation for chemical vapor deposition of the containment shell. The substrate area consisted of microsphere container dishes located in a circular pattern, connected to two electromagnets. The power supply was designed to provide amplitude, frequency, and phase control to provide random movement of the microspheres for deposition of a uniform spherical coating. Author (NSA)

N71-18326# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
FAST REACTOR MIXED-CARBIDE FUEL ELEMENT DEVELOPMENT PROGRAM Quarterly Progress Report, Apr.–Jun. 1970
J. Andersen et al 19 Aug. 1970 33 p
(Contract AT(30-1)-3415)
(UNC-5263; QPR-12) Avail: NTIS

Research directed toward development of clad PuC UC fuel rods to perform at high burnup and high power levels is

reported. Progress is reported on high-density pellet evaluation in EBR-II, annular and low-density pellet evaluation in EBR-II, fission gas release and fuel swelling, evaluation of sodium-bonded fuel, fabrication methods development for mixed oxides, evaluation of thermal properties of PuC–UC fuels, and TREAT evaluation of mixed carbides. NSA

N71-18327# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
QUANTITATIVE DETERMINATION OF THE STRUCTURE-PROPERTY RELATIONSHIPS IN NUCLEAR FUEL ELEMENT MATERIALS Quarterly Progress Report, 15 Jun. – 15 Sep. 1970
F. N. Rhines, R. T. De Hoff, and E. D. Whitney Oct. 1970 37 p refs
(Contract AT(38-1)-552)
(SRO-552-5) Avail: NTIS

An image analyzing computer was acquired, which permits the automatic measurement of the metric properties, volume, surface area, and total curvatures of porous structures. A metallographic technique suitable for preparing samples for this instrument has been devised and put into operation for nickel sinterings. Topological properties of loose stacks of powder were made more accessible through the development of a procedure for estimating genus from observations made on fracture surfaces in scanning electron microscopy, and through the use of the Coulter Counter to determine the number of particles per gram of powder. Expansion of experimental results in all areas, including quantitative microstructural analysis, gas permeability, short time mechanical properties, creep behavior, and thermal conductivity, continues for both nickel and uranium dioxide sinterings. A significant advance in sample preparation procedure provides a steady supply of uranium dioxide samples for analysis. Author (NSA)

N71-18343# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
FUNDAMENTAL MATERIALS PROBLEMS IN NUCLEAR REACTORS
A. L. Bement 27 Aug. 1970 29 p Presented at the 2d Intern. Conf. on the Strength of Metals and Alloys, Pacific Grove, Calif. Sponsored in part by AEC
(BNWL-SA-3495; CONF-700819-5) Avail: NTIS

Four general categories of materials behavior which are considered critical to reactor design and performance are discussed. The effects of radiation on hardening, fracture, swelling, and creep are examined. A review of recent progress to identify some of the important fundamental problems uncovered is presented. Author (NSA)

N71-18344# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
IRRADIATION INDUCED SWELLING AND CREEP IN FAST REACTOR MATERIALS
T. T. Claudson 21 May 1970 4 p Presented at the Intern. Meeting on Fast Reactor Fuel and Fuel Elements, Karlsruhe, Ger. Sponsored in part by AEC
(BNWL-SA-3283; CONF-700920-2) Avail: NTIS

The effects of fluence and temperature on metal swelling in fast neutron irradiation are examined as they affect the components of FFTF. Results of analyses on irradiated specimens of Types 304 and 316 stainless steels are included. NSA

N71-18345# General Electric Co., San Jose, Calif. Reactor Fuels and Reprocessing Dept.
ZIRCALOY-CLAD UO2 FUEL ROD EVALUATION PROGRAM Quarterly Progress Report, Feb. – Apr. 1970
F. H. Megerth, comp. May 1970 42 p refs
(Contract AT(04-3)-189)
(GEAP-10204; QPR-10) Avail: NTIS

Metallographic examinations of fuel rod sections performed during the initial phase of the program indicate that this surface roughness is probably a consequence of an uneven, pitting type ZrO2 corrosion layer. There were noticeable differences in the degre and extent of surface roughness among different rods, and along the length and around the circumference of a given individual rod. The axial variation in roughness tended to correspond with the axial power profile, but there were exceptions to this relationship. An increased deposition of brownish crud was observed on most rods at the three spacer locations along the fuel column. Spalling or cracking of the crud had occurred in several instances at these locations. A few rods showed spalling or cracking of the crud layer between the spacer locations. Author (NSA)

N71-18348# Oak Ridge National Lab., Tenn.
GAS-COOLED REACTOR PROGRAM Semiannual Progress Report, Period Ending 31 Mar. 1970
Nov. 1970 158 p refs
(Contract W-7405-eng-26)
(ORNL-4589) Avail: NTIS

Continuing research is reported on the high temperature gas cooled reactor, the gas cooled breeder reactor, and the prestressed concrete reactor pressure vessel. For the HTGR, work was performed on fuel element development, irradiation tests on fuel and fuel elements, fission product release and transport, nuclear safety, and corrosion studies of welds in steam generator alloys. Irradiation effects on fuel rods, and safety and afterheat removal were studied for the GCBR. Materials for the prestressed concrete pressure vessel and the structural behavior of the pressure vessels were investigated. N.E.N.

N71-18357# Gulf General Atomic, San Diego, Calif.
HIGH TEMPERATURE FAST FLUX IRRADIATION EXPERIMENT FOR MIXED-OXIDE FUEL RODS
P. W. Flynn, R. F. Hinz, S. Langer, J. R. Lindgren, R. J. Price et al 15 Oct. 1970 80 p refs
(Contract AT(04-3)-167)
(GA-10264) Avail: NTIS

The fast flux experiment in EBR-2 investigates fuel rod specimens with cladding temperatures in the range of 650 C to 800 C and at linear power generation rates of 14 to 16 kW/ft. The mixed oxide fuel is contained in 20% cold worked 316 stainless steel. SiC temperature monitors are placed in various positions along the thermal barrier to allow postirradiation determination of capsule temperatures utilizing dimensional changes during isochronal annealing of the SiC. Activated charcoal has been placed in all of the fuel rods to determine the effects of fast neutron irradiation on the sorption characteristics of the charcoal for fission products and to study the fission product distribution under reactor operating conditions. Author (NSA)

N71-18358# Idaho Nuclear Corp., Idaho Falls.
WHAM PREDICTION OF SEMISCALE TEST RESULTS
G. E. Gruen Oct. 1970 49 p refs
(Contract AT(10-1)-1230)
(IN-1431) Avail: NTIS

The WHAM computer code was used extensively for prediction of subcooled pressure histories in the semiscale system. The various semiscale configurations included a vessel with internals simulating those of a large pressurized water reactor, and a vessel with a coolant loop having a double-ended-break capability. Comparisons of the analytical results with the experimental data showed that WHAM accurately predicts the pressure histories for blowdowns produced by small breaks. Less accurate, but more conservative, predictive results were obtained from analyses of large breaks. The conclusion was reached that calculated pressure histories from WHAM are sufficiently reliable for use as forcing function input to structural dynamics codes employed in predictive analyses of postulated large PWR decompressions. Author (NSA)

N71-18376# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

ADVANCED STATISTICAL HOT SPOT ANALYSIS

A. Amendola (EURATOM, Brussels) Mar. 1970 125 p refs Transl. into ENGLISH of W. Ger. Report KFK-1134 Sponsored by US-EURATOM Fast Reactor Exchange Program

(EURFNR-814; EUR-3687; KFK-1134) Avail: AEC Depository Libraries

A general statistical method of hot spot and hot channel analysis is presented. A definition of hot spot is proposed, which allows the correlation of the probability of exceeding certain critical temperatures to the size of the zone in which they occur. The assumptions of previous methods are reviewed and the hot channel factors are demonstrated to be independent of the assumed spot size. Effects of local and global uncertainties, and the radial and axial power profile in the core are taken into account. The probability that hot spots occur in exactly one, or exactly two, or in exactly n subassemblies is evaluated. A description is presented of FORTRAN-4 code SHOSPA, which is based on the proposed method and is applicable to any type of reactor and any power profile as long as the core is constituted of bundled fuel rods. A numerical application of the code to the sodium cooled fast reactor Na-2 is shown. Author (NSA)

N71-18496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

METHODS FOR DETERMINING BURNUP IN ENRICHED URANIUM-235 FUEL IRRADIATED BY FAST REACTOR NEUTRONS

Paul J. Richardson Washington Jan. 1971 20 p refs

(NASA-TM-X-2153; E-5900) Avail: NTIS CSCL 18I

Fission yields of those fission products that vary less than 5 percent in a thermal or a fast neutron environment are listed. The potential burnup monitors are discussed with respect to their diffusion behavior during high-temperature irradiations, ease of mass spectrometer analysis, and adverse effects of neutron capture reactions. Recommendations are made for the most reliable methods. Author

N71-18508# General Electric Co., Sunnyvale, Calif.

FABRICATION OF NON-FUEL CORE COMPONENTS FOR SEFOR

D. T. Ikeuye and F. E. Young Feb. 1970 152 p refs

(Contract AT(04-3)-540)

(GEAP-13595) Avail: NTIS

The fabrication data and processes for the production of the extension rods, tightener rods, tightener sleeves, and special rods for the SEFOR reactor are documented. The extension rods provide the neutron and gamma shielding above the core. The functions of the tightener rods are to lock the surrounding fuel rod-extension rod assembly in position in the fuel channel, provide additional shielding above the core, and increase the Doppler effect. The tightener sleeve is the basic internal structural member of the fuel assembly and serves to provide spacing between the fuel rods. The major tooling, techniques of fabrication, fabrication processes, and quality control efforts used in the fabrication of the non-fuel core components are described. Author (NSA)

N71-18628*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NUCLEAR POWER FOR SURFACE EFFECT VEHICLE AND AIRCRAFT PROPULSION

Frank E. Rom [1970] 21 p refs Presented at the 7th Ann. Meeting of the AIAA, Houston, Tex., 19 – 22 Oct. 1970

(NASA-TM-X-52963) Avail: NTIS CSCL 18L

Preliminary results of an economic study of large nuclear surface effect vehicles and aircraft indicate that these vehicles may have the potential for hauling transoceanic commerce at rates of 1 to 2 cents per ton mile. Transoceanic commerce forecast for 1980 indicates that it would take 1500 10,000 ton gross weight surface effects vehicles to handle all the cargo that is worth shipping at 1 to 2 cents per ton mile. Similarly, it would take 500 10,000 ton aircraft to handle this same volume. One of the most important technical problems is the problem of safety during high speed impacts. Tests of mobile reactor models indicate a potential for withstanding impacts up to 1000 feet per second with reinforced concrete without rupturing or producing leaks in the reactor containment vessel. Author

N71-18711# Oak Ridge National Lab., Tenn.

DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART 8: BOILING WATER REACTOR ACCIDENT RADIOLYSIS STUDIES

H. E. Zittel Oct. 1970 18 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2412-Pt-8) Avail: NTIS

Boiling water reactors (BWR) are designed so that in case of a loss-of-coolant accident, water from the pressure suppression pool can be recirculated through the reactor core. The primary function of this recirculating water is pressure suppresion during the system blowdown sequence and core cooling. The water may be expected to be exposed to a radiation dose of > 10 to the 8th power rads in a relatively short time. Because of the relatively small containment volume of a typical BWR, the rate of evolution as well as the steady-state concentration of radiolytic gas is extremely important. The effects of various parameters on these points are considered. The parameters covered are flow rate (100 to 10,000 gpm), temperature (65 to 125 C), gas-liquid ratio (1.0 to 5.0) and composition of cover gas (air, 95% N2 - 5% O2). The variation of these parameters within the limits specified indicates that the lower limit for steady-state radiolytic hydrogen concentration is between approximately 3 to 4 vol %. Author (NSA)

N71-18728# North Carolina State Univ., Raleigh. Dept. of Nuclear Engineering.

DIFFUSION OF GASES IN SOLIDS Annual Progress Report, 1 Nov. 1969 – 1 Oct. 1970

Thomas S. Elleman, Andres Sy Ong, and John H. Austin 13 Oct. 1970 71 p refs

(Contract AT(40-1)-3508)

(ORO-3508-8) Avail: NTIS

Progress is summarized on a study of the factors that affect rare-gas diffusion in ionic solids; and the measurement of tritium diffusion in fuel element claddings. Xenon 133 diffusion in CaF2 single crystals was studied using fission-recoil doping to inject the xenon. A trapping model was developed and the values of trap concentration and trap retention time that best fit the experimental results were determined. The diffusion of tritium in Type 304 stainless steel was studied by injecting tritium into specimen surface layers through the Li6(n,alpha)H3 reaction, heating to establish a diffusion gradient, and then analyzing the tritium in sections removed by electro-polishing. Author (NSA)

N71-18770# Naval Intelligence Command, Alexandria, Va. Translation Div.

REACTORS AND THE SCIENCE OF MATERIALS

D. M. Srorov et al 4 Dec. 1970 155 p Transl. into ENGLISH from the book "Reaktornoe Materialovedenie" Moscow, Atomizdat; 1968 155 p

(AD-715459; NIC-TRANS-3146) Avail: NTIS CSCL 18/10

The report is divided into two sections. The first section gives a detailed review of uranium and its alloys dealing with their physical, mechanical, and chemical properties important to nuclear reactors. The second section discusses the main properties of the following types of ceramic fuels: The first group includes ceramics

produced on the basis of oxides of uranium, thorium and plutonium both separately and in mixtures, and also mixed with other oxides containing no fissionable isotopes; and the second group includes nonoxide ceramic materials: carbides, nitrides, sulfides, phosphides and other compounds of uranium, thorium and plutonium (separately or mixed together, and also mixed with other compounds not containing fissionable isotopes). GRA

N71-18782*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SHIELD WEIGHT OPTIMIZATION USING MONTE CARLO TRANSPORT CALCULATIONS

Thomas M. Jordan (A.R.T. Res. Corp.) and Millard L. Wohl Mar. 1971 9 p refs Presented at the Natl. Symp. on Nat. and Manmade Radiation in Space, Las Vegas, Nev., 1–5 Mar. 1971; sponsored by NASA and AEC

(NASA-TM-X-52973; E-6179) Avail: NTIS CSCL 20H

The theory used in FASTER 3, a Monte Carlo computer program for the transport of neutrons and gamma rays in complex geometries, is outlined. The code has the additional capability of calculating the minimum weight layered unit shield configuration which will meet a specified dose rate constraint. It includes the treatment of geometric regions bounded by quadratic and quadric surfaces with multiple radiation sources which have a specified space, angle, and energy dependence. The program calculates, using importance sampling, the resulting number and energy fluxes at specified point, surface, and volume detectors. Results are presented for sample problems involving primary neutron and both primary and secondary photon transport in a spherical reactor shield configuration. These results include the optimization of the shield configuration. Author

N71-18783# Joint Publications Research Service, Washington, D.C.

STUDIES IN PHYSICS AND POWER ENGINEERING

29 Jan. 1971 145 p refs Transl. into ENGLISH of various Obninsk Inst. of Phys. and Power Eng. reports

(JPRS-52290) Avail: NTIS

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8. CHANGE IN REACTIVITY OF THE BR-5 REACTOR I. A. Yefimov et al p 125–141 (See N71-18791 08-22)

N71-18784# Joint Publications Research Service, Washington, D.C.

CALCULATED VALUES OF THE CHARACTERISTICS OF FAST POWER REACTORS AS FUNCTIONS OF VARIATIONS OF THE CONSTANTS USED IN THE CALCULATION AND REQUIREMENTS FOR ACCURACY OF THESE CONSTANTS [RASCHETNYKH ZNACHENIY KHARAKTERISTIK ENERGETICHESKIKH BYSTRYKH REAKTOROV OT IZMENENIY KONSTANT, ISPOLZUYEMYKH V RASCHETE, I TREBOVANIYA K TOCHNOSTIETIKH KONSTANT]

S. M. Zaritskiy et al *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 1–24 refs (See N71-18783 08-22) Presented at Tripartite Soviet-Belgian-Dutch Symp. on Probl. of Fast Reactor Phys., Melekess, USSR, 15–21 Nov. 1969

Avail: NTIS

Methods of perturbation theory are used to produce data on the sensitivity of the calculated values of critical parameters and breeding factors of fast power reactors to changes in the constants used in calculation. Reactors are studied with metallic, carbide, and oxide plutonium fuel with core volumes of 2.5 and 5 cu m. A method is discussed for estimating the error in constants which can be considered permissible from the point of view of required accuracy of reactor design. Concrete estimates are made of the accuracy required for sigma sub c, sigma sub f, and nu sub f of U-238 and Pu-239 in order to provide acceptable accuracy in calculating the characteristics listed. Author

N71-18786# Joint Publications Research Service, Washington, D.C.

STUDY OF THE POWER AND THERMAL EFFECTS OF THE BR-5 REACTOR [ISSLEDOVANIYE MOSHCHNOSTNYKH I TEMPERATURNYKH EFFEKTOV REAKTORA BR-5]

N. I. Aristarkhov et al *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 46–65 refs (See N71-18783 08-22)

Avail: NTIS

The relationship between the power of a reactor and the reactivity (position of the control rods) was studied in several modes. The measurements were performed using the standard automatic control system. The first method consisted of studying the displacement of control rods with a single, sudden change in power. Comparison of curves produced at various power levels allows the power and thermal components of the change in reactivity to be determined. In the second method a pseudo-random binary signal was applied to the reactor power controller. The reactor changed its power output by + or − 1% from the fixed mean power level upon receipt of the signal. The mutual correlation between the perturbance and the position of the control rod is calculated. The calculations permit estimation of the individual components of the temperature effects of reactivity on the basis of experimental data. Author

N71-18787# Joint Publications Research Service, Washington, D.C.

STRUCTURE OF THE CROSS SECTIONS OF URANIUM 238 IN THE AREA OF UNRESOLVED RESONANCES AS A FUNCTION OF TEMPERATURE [TEMPERATURNAYA ZAVISIMOST STRUKTURY SECHENIY URANA 238 V OBLASTI NERAZRESHENNYKH REZONANSOV]

A. A. Vankov et al *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 66–83 refs (See N71-18783 08-22)

Avail: NTIS

In fast power reactors with ceramic fuel and sodium coolant, the Doppler temperature coefficient of reactivity is the main factor compensating for the increase in reactivity resulting from an accidental removal of sodium from the core. Direct measurement of the parameter determining the Doppler effect for the primary fissionable isotopes throughout the entire energy area where it appears is considered. Author

N71-18788# Joint Publications Research Service, Washington, D.C.

STUDY OF EFFICIENCY OF VARIOUS MATERIALS IN THE BFS-16 FAST REACTOR [ISSLEDOVANIYE EFFEKTIVNOSTI RAZLICHNYKH MATERIALOV V BYSTROY SBORKE BFS-16]

N. Ye. Gorbatov et al *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 84-102 refs (See N71-18783 08-22)
Avail: NTIS

The results of experimental studies of perturbations resulting from various materials in the BFS-16 fast reactor are presented. Calculated and experimental quantities are compared. The calculations consider the effects of resonant self-screening of the specimen and perturbation of the neutron field by the specimen. Methodology and results are presented for calculation of the influence of scattering of the specimen on unblocking of resonant cross sections of the surrounding medium. Author

N71-18789# Joint Publications Research Service, Washington, D.C.

INTEGRAL METHOD OF EXPERIMENTAL DETERMINATION OF nu(eff) IN REACTORS WITH A HARD NEUTRON SPECTRUM [INTEGRALNYY METOD EKSPERIMENTALNOGO OPREDELENIYA VELICHINY nu(eff) V REAKTORAKH S ZHESTKIM SPEKTROM NEYTRONOV]

A. I. Mogilner *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 103-108 refs (See N71-18783 08-22)
Avail: NTIS

Calculating the value of the effective number of neutrons (nu sub eff) formed upon fission by neutrons of varying energies is considered. The most detailed information on the energy dependence of nu sub eff can be produced by direct measurement of this quantity in monochromatic beams of neutrons. The development of an experimental method for measuring the value of nu sub eff in zero power reactors with an effective neutron spectrum on the order of 1 keV and higher is duscussed. In this case the value of the k sub infinity in a sufficiently homogeneous assembly where practically the only absorber is the fissionable material is determined almost completely by the effective value of nu sub eff. Author

N71-18791# Joint Publications Research Service, Washington, D.C.

CHANGE IN REACTIVITY OF THE BR-5 REACTOR [IZMENENIYE REAKTIVNOSTI REAKTORA BR-5]

I. A. Yefimov et al *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 125-141 (See N71-18783 08-22)
Avail: NTIS

Calculation of the rate of change of reactivity is discussed for nuclear reactor design and determination of the lengths of operating periods. The BR-5 reactor is used as an example, since its fuel elements and equipment operate under conditions approximating those of industrial operation. The small dimensions of the BR-5, comparatively frequent change of operating mode and other design specifics result in a complex dependence of the change of reactivity with time. Author

N71-18827# Army Engineer Reactors Group, Fort Belvoir, Va. Engineering Div.

SM-1 CORE 3 3.5 MWYR CORE PHYSICS REPORT Final Report

Charles D. Henry, III 15 Nov. 1970 88 p refs
(AD-715850; ED-7008) Avail: NTIS CSCL 18/11

The report discusses the conduct and results of the 3.5 MWYR core physics tests on SM-1 core 3. The results are evaluated and compared with previous results where possible. The results are used to check the present behavior of the core, as compared to the predicted behavior. Various figures and tables are used to illustrate the measured results. Author (GRA)

N71-18855# Naval Intelligence Command, Alexandria, Va. Translation Div.

STUDY OF THE FEASIBILITY OF INCREASING THE POWER OF WATER-COOLED REACTORS BY THE INTENSIFICATION OF HEAT EXCHANGE AS A RESULT OF ARTIFICIAL ROUGHNESS [IZUCHENIE VOZMOZHNOSTI POVYSHENIYA MOSHCHNOSTIVODOOKHALZHDAEMYKH REAKTOROV PUTEM INTENSIFIKATSII TERPLOOBMENA ZA SCHET ISKUSSTVENNOI SHEROKHVATOSTI]

Sh. P. Abramidze et al 4 Dec. 1970 7 p refs Transl. into ENGLISH from At. Energ. (Moscow), v. 27, no. 6, Dec. 1969 p 547-549
(AD-715461; NIC-TRANS-3145) Avail: NTIS CSCL 18/9

The decision was made to intensify the heat transfer from the fuel elements by the use of artificial roughness in order to increase the power. Artificial roughness should be understood to mean the set of elements of the boundary layer interrupter type applied to the heat transfer surface. The use of this effect has not yet been given proper attention. This can be explained by the fact that according to the theory of this effect, advanced by W. Nunner in 1956, it was believed that in the case of nonmetallic heat transfer agents, the degree of intensification of heat exchange ought to be as slight as possible. Author (GRA)

N71-18866*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPERATING CHARACTERISTICS OF THE PRIMARY FLOW LOOP OF A CONCEPTUAL NUCLEAR BRAYTON SPACE POWERPLANT

George E. Turney, Arthur W. Kieffer, and Edward J. Petrik Washington Mar. 1971 37 p refs
(NASA-TM-X-2161) Avail: NTIS CSCL 18L

An analytical study was made of the steady-state and transient operating characteristics of the lithium cooled primary flow loop of a conceptual nuclear Brayton space powerplant. From the system investigation, it was determined that (1) the steady-state power of the reactor varies linearly with (a) the inserted reactivity and (b) the flow rate of inert gas in the Brayton power conversion loop (2) the flow rate of lithium in the primary loop has a small effect on the reactor steady-state power. The transient changes in the reactor power and temperature of the primary loop were determined for step input disturbances in (1) inserted reactivity, (2) lithium flow rate in the primary loop, and (3) inert-gas flow rate in the Brayton power conversion loop. The response of the system to these step changes can be characterized as stable and highly damped. Author

N71-19179# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.

COMPATIBILITY OF VANADIUM ALLOYS WITH CARBIDE FUELS

G. A. Whitlow, J. Y. Chang, R. C. Deklever, P. M. French, and M. H. Hodge [1970] 23 p refs

(Contract AT(30-1)-3791)
(TID-25599) Avail: NTIS

An experimental program is described, the objective of which was to examine the compatibility of three developmental vanadium alloys with several carbide fuels in the presence of a sodium bonding medium. In 3500-hour compatibility tests at 800 C, some incompatibility was observed between three vanadium alloys and sodium bonded carbide fuels. The formation of an oxycarbide phase on the fuel pellet surface by reaction of the oxygen in the sodium bond with the fuel is thought to be the mechanism for the postulated carbon absorption and observed metallographic and microhardness changes in the vanadium alloys. There are indications that less incompatibility occurs with Cr23C6 modified (U,Pu)C than with hyperstoichiometric (U,Pu)C or stoichiometric UC fuels. Author (NSA)

N71-19210# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
NUCLEAR ENGINEERING RESEARCH AT THE ROCKEFELLER GENERATOR Final Report, Jul. 1962–Aug. 1970
Aug. 1970 154 p refs
(Grants NSF G-25049; NSF GP-1657; NSF GK-654; NSF GK-2594)
Avail: NTIS

Studies to obtain a better understanding of the behavior of neutrons in fast reactors are presented. The research included the following areas: fast neutron kinetics, time dependent neutron spectrometers, inelastic scattering cross sections of fast neutrons, and measurement of isomeric half lives of F-19, Cd-111, Ta-181, and Sc-45. F.O.S.

N71-19236# Oak Ridge National Lab., Tenn.
CRYOGENIC SYSTEM FOR THE SUPERCONDUCTING MAGNETS OF A FULL SCALE THERMONUCLEAR POWER PLANT
A. P. Fraas Dec. 1970 11 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3097) Avail: NTIS

A preliminary estimate was made of the heat load on a cryogenic system for cooling the superconductivity coils of a 5000-MW(t) thermonuclear power plant. The size, cost, and power requirements for this cryogenic system were estimated, using data for the large liquid-helium refrigeration system employed for the 65-ft diameter by 125-ft-tall space-simulation chamber. Author (NSA)

N71-19344# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
DEFICIENT COOLING Quarterly Progress Report, 1 Apr.–30 Jun. 1970
Jun. 1970 38 p refs
(Contract AT(04-3)-189)
(GEAP-10221) Avail: NTIS

A simplified analysis of boiling two-phase transients, involving pressure and/or flow decay has been made using the method of characteristics. The results appear encouraging for analysis of transient data and work is presently in progress on evaluation of representative transient depressurization data. Procurement of materials for subchannel sampling of three areas of a nine-rod test section has been completed and installation started. One-rod exploratory tests have revealed poor heat transfer conditions around supports of large (1/4 inch) diameter in contact with the heater surface. Flow cycling tests have proved the adequacy of the designed equipment and have also shown that critical heat flux is indicated to be sensitive to changes in quality of 0.0005 at 1000 psi. The analog-digital conversion routine and programming for calculation of transient data is essentially complete. Some minor de-bugging is still in progress. Author (NSA)

N71-19346# Oak Ridge National Lab., Tenn.
TESTING OF CERAMIC INSULATOR COMPACTION IN SHEATHED THERMOCOUPLES
K. R. Carr Dec. 1970 38 p refs
(Contract W-7405-eng-26)
(ORNL-4439) Avail: NTIS

Two improved methods (direct measurement and liquid absorption) were developed after tests of dye penetration and helium flow methods showed them to be not suitable. Thermocouple materials from 15 manufacturers were tested to evaluate all four methods. Although both the direct measurement method and the liquid absorption method, with kerosene as the absorbed liquid, are a satisfactory means of measuring the compaction of magnesium oxide insulation in sheathed thermocouples as small as 1/16 in. o.d., the liquid absorption method is superior. Its accuracy is + or − 2% maximum theoretical density (100% MTD is 3.58 g/cu cm, the density of a single MgO crystal). The accuracy of the direct measurement method is also + or − 2% MTD, but the method cannot be applied in every case because sometimes it is difficult to separate the insulator from the sheath and wires. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-18272# California Univ., Berkeley. Lawrence Radiation Lab.
SIMPLIFIED HELIUM CRYOSTATS FOR SUPERCONDUCTING DIPOLES AND QUADRUPOLE MAGNETS
Michael A. Green 29 Jul. 1970 18 p refs
(Contract W-7405-eng-48)
(UCRL-19764) Avail: NTIS

Extensive use of superconducting dipole and quadrupole magnets requires study of the cryostat problem from a systems viewpoint. A number of suggestions that should lead to magnet cryostats of minimum cost are presented. The interaction of the cryostat with the refrigeration system is discussed. Basic cryostat design parameters are treated and design conditions for three types of superconducting dipole and quadrupole cryostats are presented. Author (NSA)

N71-18273# California Univ., La Jolla. Dept. of Physics.
EXPERIMENTS OF THE FUTURE AT ULTRALOW TEMPERATURES (LESS THAN 0.3 K)
J. C. Wheatley [1970] 30 p refs
(UCSD-34-P-143-30) Avail: NTIS

Four major technical advances in ultralow temperature physics in the 1960's are cataloged. Areas that will be dominant in the 1970's are listed: quantum fluids and solids, polarized or oriented nuclei, magnetism, noise, electrical phenomena, third law of thermodynamics, thermometry, thermal contact, materials, cooling methods, and lower temperatures. Some of the ideas, concepts, and possible experiments are discussed. NSA

N71-18545# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
ASYMPTOTIC MAGNETIC SURFACES
Guenther Otto Spies and Dietrich Lortz Dec. 1969 39 p refs
(IPP-6/83) Avail: AEC Depository Libraries

Toroidal magnetic fields where the unperturbed field has closed lines of force are considered. On rather weak assumptions it is shown that single-valued formal solutions exist, and that the asymptotic magnetic surfaces F = const are uniquely determined up

to any order. Recursion formulas are derived that allow calculation of any order of F from its lower orders, and explicit expressions are given for F sub 0 that depend on whether the rotational transform is of the same or of higher order than the perturbing field. For the special cases of stellarator-like vacuum fields, a necessary condition is derived for the asymptotic magnetic surfaces to be toroidally closed. As another application, the lowest order of an adiabatic invariant is constructed for the longitudinal guiding center motion. Author (NSA)

N71-18546# Case Western Reserve Univ., Cleveland, Ohio. Electrochemistry Research Lab.

DIFFERENTIAL CAPACITANCE STUDY OF STRESS-ANNEALED PYROLYTIC GRAPHITE ELECTRODES

Jean-Paul Randin and Ernest Yeager 1 Nov. 1970 23 p refs (Contract N00014-67-A-0404-0006) (AD-715668; TR-29) Avail: NTIS CSCL 20/3

The non-faradaic capacity of electrodes prepared from high pressure stress-annealed pyrolytic graphite has been examined in aqueous solutions using an ac impedance bridge. Such materials have a rocking angle (X-ray diffraction) as small as 0.4 degrees and the properties of surfaces oriented parallel to the basal plane approach rather closely those of single crystal graphite. The differential capacity measured on this surface has a near parabolic dependence on electrode potential with no evidence of a hump and a minimum of about 3 microfarads/sq. cm in 0.9 M NaF. This low value is explained on the basis that a substantial fraction of the potential change between the electrode bulk and the solution bulk occurs across a space charge layer within the graphite.

Author (GRA)

N71-18567# Interand Corp., Rockville, Md.

ACOUSTICAL PROPERTIES OF MAGNETOSTRICTIVE AND METALLIC MATERIALS FOR NAVAL APPLICATIONS Final Report 15 Oct. 1969–15 Oct. 1970

William W. Lester 15 Oct. 1970 92 p refs (Contract N00014-70-C-0106) (AD-715654; IW-69-11-F) Avail: NTIS CSCL 20/12

Experimental work is described concerning plastic flow in magnetic metals, particularly wire samples of nickel and iron. Plastic flow has been induced by the combined action of ultrasonic and static stressing. The resulting behavior of magnetic permeability, residual stress, electrical conductivity, separated acoustic loss mechanisms, and separated elastic Lame constants have been investigated. Measurements of the plastic strain limit of nickel are presented, as are measurements of stress combinations required to produce plastic flow in nickel. Time dependent phenomena, such as the elastic behavior of samples after plastic flow are also presented. Some conjectures on practical applications of the work are presented. Author (GRA)

N71-18568# J. G. Engineering Research Associates, Baltimore, Md.

RANDOM STRUCTURAL ACOUSTICS, VOLUME 1

Joshua E. Greenspon May 1970 89 p refs (Contract Nonr-5040(00)) (AD-715682) Avail: NTIS CSCL 20/1

This volume is the first part of a two part monograph on the subject of Random Structural Acoustics. The main purpose of the monograph is to treat the basic elements of structural-acoustic systems under random loading in order to give the reader a better understanding of the sound radiation from structures under the sea. This volume presents the fundamental relations. Volume two will go into the applications. Author (GRA)

N71-18572# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.

EXTERNAL SOUND FIELD EFFECT ON A TURBULENT LAYER [INFLUENCE D'UN CHAMP ACOUSTIQUE EXTERIEUR SUR UNE COUCHE LIMITE TURBULENTE]

Pierre Gougat Sep. 1970 103 p refs In FRENCH (Rept-70-8) Avail: NTIS

The response of a boundary layer to harmonic oscillations is analyzed. The study is restricted to the influence of an acoustic field on heat exchange in a turbulent boundary layer on a flat plate. Wind tunnel tests have been performed using a hot-wire anemometer linked to a Wheatstone bridge. It is shown that an ultrasonic field is not appropriate and that, with the wind tunnel used, measurements were not possible for low frequencies. ESRO

N71-18747*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTICAL CHARACTERISTICS OF AN ENERGETIC VACUUM CARBON ARC

T. W. Sheheen Dec. 1970 13 p refs Presented at the Am. Phys. Soc. Meeting, Palo Alto, Calif., 28–30 Dec. 1970 (NASA-TM-X-52966; E-6169) Avail: NTIS CSCL 20F

Absolute intensities of the ultraviolet spectral lines, from 800 to 2000 A, emitted from an energetic vacuum arc were determined as a function of operating parameters. The arc under investigation is a 31-cm magnetically confined dc discharge with a current density greater than 300 A/sq cm, operating in a region where the background gas pressure is less than 1 m torr. Absolute intensities were measured using a 0.5 meter Seya Namioka monochromator with a calibrated sodium salicylate coated photomultiplier tube as the detector. Calibration of the photomultiplier tube was obtained by measuring the currents produced in a double ion chamber by the photoionization of Xe when irradiated by the 977 A carbon (III) line. It was found that under proper conditions photon fluxes of 10 to the 14th power photons/sq cm sec could be obtained at the exit slit of the monochromator. Author

N71-18771# Naval Postgraduate School, Monterey, Calif.

TRANSMISSION OF SOUND THROUGH A RANDOMLY ROUGH AIR-SEA INTERFACE

James Dixon Hagy, Jr. (M.S. Thesis) Sep. 1970 133 p refs (AD-715566) Avail: NTIS CSCL 20/1

The Helmholtz integral and the Kirchhoff approximation have been used to develop predictions for the transmission of sound through a rough air-sea interface. A model study was conducted with wind-driven surfaces generated in a large anechoic tank. The frequencies used were scaled to be equivalent to low audio frequencies with moderate seas. The coherent component of the transmitted acoustic intensity was tested for exponential decrease with increasing values of the roughness parameter. An empirical correction factor was determined to give a corrected roughness. Author (GRA)

N71-18797# Air Force Cambridge Research Labs. Bedford, Mass.

PERMEABLE MATTER AND THE VECTOR H

Leonard J. Eyges 2 Oct. 1970 22 p refs *Its* Phys. Sci. Research Papers No. 428 (AD-715890; AFCRL-70-0536) Avail: NTIS CSCL 20/3

The purpose of the report is to provide a new clarity of insight into concepts that are involved in the design and understanding of devices which have importance in a wide variety of Air Force applications. The formulas derived herein provide new tools for clarifying the mode of operation and optimizing the performance of devices that involve magnetic components. A previous discussion of dielectric matter is extended to the problem of magnetic dipolar matter. The calculation of the external field of a sample of such matter by Amperian currents is reviewed, and the meaning of the average internal field that they can be shown to correctly predict is discussed. Author (GRA)

N71-18916# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.

UHV MOESSBAUER EMISSION SPECTRA OF THIN IRON FILMS

M. N. Varma and R. W. Hoffman [1969] 7 p refs Sponsored by AEC

(COO-623-164) Avail: NTIS

Mossbauer emission spectra are used to determine relaxation effects of Fe57m in thin iron films. The spectra from the radioactive films have been analysed at room temperature, liquid nigrogen and 15 K over a range of thickness from 3 × 10 to the 16th power atoms/sq cm to 0.12 × 10 to the 16th power atoms/sq cm (25 A to 1 A). Samples thinner than 7 A show the following characteristics: a positively resolved doublet interpreted as quadrupole splitting of about 0.6 mm/sec. independent of thickness and temperature; a Mossbauer fraction roughly constant with temperature; one line increases in width and area and the other decreases as the temperature is lowered. Samples thicker than 10 A are approximately characteristic of bulk iron. The transition is ascribed to superparamagnetic fluctuations in the internal field but the detailed line shapes are not simply explained. A multilayer 25 A sample has six lines in the normal positions at 15 and 80 K, but the outer lines show a decreasing intensity as the temperature increases until they vanish at room temperature. Author (NSA)

N71-19010 Yale Univ., New Haven, Conn.

ROTATING SUPERCONDUCTORS AND RELATED EFFECTS

Norman Frederick Brickman (Ph.D. Thesis) 1969 122 p

Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-2702

An apparatus was constructed for use in a liquid helium cryostat for the measurement of small magnetic field changes occurring within a detection chamber. The main experiment involved rotating solid and hollow super-conducting cylinders to measure the uniform magnetic field, called the London Moment, that is generated in these cylinders due to their rotation. The agreement with theory for all the samples tested was found on average to be within + or − 3 percent provided that the effective mass and charge for the super-conducting particles was taken as twice the free electron values. Measurements were also made on the temperature dependence of magnetic flux trapped in stationary hollow thin-wall superconducting aluminum cylinders near their critical temperature, confirming the theory for the effect as well as showing the electron mean free path in the cylinder wall is approximately equal to the thickness of the film. Dissert. Abstr.

N71-19036*# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.

INCIPIENT AND STEADY BOILING OF LIQUID NITROGEN AND LIQUID HYDROGEN UNDER REDUCED GRAVITY

Herman Merte, Jr. Nov. 1970 134 p refs

(Contract NAS8-20228; ORA Proj. 07461)

(NASA-CR-103047; TR-7) Avail: NTIS CSCL 20L

The parameters varied include the fluid used, heater surface temperature, geometry, orientation, and the ratio of acceleration to gravity(a/g). Reduced gravity was obtained with a drop tower designed for liquid hydrogen applications which has 32 ft free fall distance, giving 1.34 sec of free fall. A transient calorimeter technique was used with a variety of geometries. Results are presented for a 1 in. diam sphere in LH2 at a/g = 1 and a/g = 0, which are similar in character to the results obtained earlier with LN2. The results for a 2-1/4 in. diam sphere in both LN2 and LH 2 at a/g = 1 are presented, to ascertain the effect of size. The transient calorimeter technique was adapted to flat surfaces to determine the influenc of geometry and orientation on boiling of LN2 and LH2 at a/g = 1 and reduced gravities. The results of incipient boiling of LN2 on polished aluminum at a/g = 1 are presented, along with incipient boiling of LH2 on a fiber glass surface similar to that used in the LH2 tank of the Saturn 5-4B. Measurements of incipient boiling at a/g = 1 and a/g = 0 were made in both LN2 and LH2, using a transient technique with a platinum wire. Author

N71-19037*# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

SHOCK-TUBE MEASUREMENTS OF THE VIBRATION-VIBRATION ENERGY EXCHANGE PROBABILITY FOR THE CO-N2 SYSTEM

T. Ian McLaren and John P. Appleton Nov. 1970 26 p refs *Its* Fluid Mech. Lab. Publ. No. 70-10

(Contracts NAS2-4919; N0014-67-A-0204-0040; ARPA Order 322)

(NASA-CR-116816) Avail: NTIS CSCL 20D

It was determined that at a temperature of about 4000 K, the measured probability, agrees fairly well with the theoretical prediction of other authors(SSH theory), but that with decreasing temperature the measured probability falls considerably below the SSH theory prediction. The experimental results also demonstrate that over the temperature range 2000 to 4000 K, argon and nitrogen are about equally efficient as translation-vibration collision partners for vibrational relaxation of CO, while argon is between 2 and 3 times less efficient than N2 for vibrational relaxation of N2 molecules. Author

N71-19038 Lehigh Univ., Bethlehem, Pa.

SHOCK TUBE STUDY OF VIBRATION-VIBRATION ENERGY TRANSFER IN NITROGEN-NITROUS OXIDE MIXTURES

James Franklin Roach (Ph.D. Thesis) 1969 151 p

Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-1740

An experimental investigation of near-resonant vibrational energy transfer in shock heated mixtures of N2 and N2O was carried out. Probabilities for the vibration-vibration energy transfer between N2 and the asymmetric mode of N2O were measured from 500 to 1200 K. The data is compared to theoretical predictions and is found to be in good agreement with the long-range force theory of Sharma and Brau for dipole-quadrupole vibration-vibration coupling. It was observed that relaxation of the asymmetric mode is initially very fast, but in the final approach to equilibrium the relaxation is retarded as a result of vibration-vibration coupling with N2. Under favorable flow conditions, the N2 relaxation behind the shock was measured simultaneously from the density profile. The N2 relaxation rate was found to be the same as the asymmetric mode relaxation rate in the final approach to equilibrium. Dissert. Abstr.

N71-19039 Tennessee Univ., Knoxville.

MEASUREMENTS OF REFRACTIVE INDEX, DENSITY, AND REFLECTED LIGHT DISTRIBUTIONS FOR CARBON DIOXIDE AND WATER CRYODEPOSITS AND ALSO ROUGHENED GLASS SURFACES

Peter Roland Mueller (Ph.D. Thesis) 1969 184 p

Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-2127

By using interference techniques, the density and the refractive index were measured as a function of the wavelength of water and carbon dioxide cryodeposit formed at a temperature of 77 K and a deposition pressure of about 0.0004 mm Hg. It is shown that the Lorenz-Lorentz constant at a certain wavelength computed from the refractive index and density of the cryodeposit is equal to that of the same substance at different temperature and phase, but at the same wavelength. Biangular distributions of the radiation reflected from water and carbon dioxide deposit formed at 77 K on polished copper and black paint substrates were obtained for various deposit thicknesses and monochromatic light of 0.7 to 1.0

micron. The influence of the deposition rate and of the wavelength of the radiation on the biangular distributions and also on the off-specular shift of the peak of the reflected radiation are investigated. Dissert. Abstr.

N71-19166 Connecticut Univ., Storrs.
A MODEL OF THE LIQUID SURFACE
Phillip Raoul Douville (Ph.D. Thesis) 1969 250 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 70-1251

Experimental values of surface tension as a function of pressure were determined for the following systems: methane-water, ethane-water, nitrogen-methanol, methane-methanol, ethane-methanol, nitrogen-benzene, argon-benzene, methane-benzene, ethane-benzene, methane-n-hexane, and ethane-n-hexane. In addition, surface tension data are compiled for the following systems: nitorgen-water, argon-water, argon-methanol, nitrogen-n-hexane, argon-n-hexane. The experimental data were applied to the calculation of the fraction of the surface covered by gas (f). The solution of the Langmuir adsorption isotherm using f values indicated a definite relationship between gas adsorption on solid and liquid surfaces for surface coverages. Highly miscible gas-liquid pairs, ethane-n-hexane and ethane-benzene, indicated that surface excesses tended to decrease as the gas and liquid phases approached each other in composition. Dissert. Abstr.

N71-19171*# Stanford Univ., Calif. Dept. of Applied Mechanics.
GYROSCOPIC CONTROL OF A RIGID BODY CONSTRAINED TO ROTATE ABOUT A FIXED AXIS
M. R. Headrick and T. R. Kane Nov. 1970 14 p
(Grant NGR-05-020-209)
(NASA-CR-116870; SUnTR-201) Avail: NTIS CSCL 20K

The possibility of using gyroscopic effects to control either the spin rate or the orientation of a rigid body which is constrained to rotate about a fixed axis is discussed. A theoretical basis for an experimental exploration of man's ability to employ gyroscopic effects while maneuvering in free space is undertaken. The system to be analyzed is described in detail and equations of motion are formulated. Open loop and closed loop control is described. Finally, the use of these results as the basis for an experiment involving human subjects is discussed. Author

N71-19208*# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
JOSEPHSON TUNNELING THROUGH NORMAL METAL BARRIERS
Roger R. Rockefeller (Ph.D. Thesis) Jun. 1970 125 p refs
(Grant NGL-31-003-020)
(NASA-CR-116871; SIT-P251(6/70); TR-1) Avail: NTIS CSCL 20C

Phase-lock techniques were employed to study the electrical and magnetic properties of superconductor-normal metal-superconductor junctions. The junctions were of the mechanical contact type, using tin and gold. Josephson tunneling was observed through 10,500 A of gold, and the current-voltage characteristics were found to agree with current theories, including the effects of flucutations. Voltage-magnetic field characteristics were used to verify the existence of excess supercurrents in the junction, and to determine the previously unknown current carrying area of the junction. A model, based on the deGennes theory and taking into account the effect of barrier resistance, was proposed to explain the data. The critical current dependence on the normal metal thickness, resistance and temperature was in agreement with the theory. Author

N71-19215 Yale Univ., New Haven, Conn.
MUONIUM HYPERFINE STRUCTURE MEASUREMENTS AT VERY WEAK MAGNETIC FIELD
Philippe Crane, Jr. (Ph.D. Thesis) 1969 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 70-2718

An accurate value of the muonium hyperfine structure interval is of interest because it can be used to test the application of quantum electrodynamics to the muon-electron system, or to determine accurate values for some of the fundamental constants. Measurements of the hfs and its density dependence at very weak magnetic field provide an independent test of the previous high field results, and increase the precision of these results. Muonium resonances have been observed for the first time using krypton as the target gas. Krypton has the advantage of greater stopping power than argon at low pressures. Dissert. Abstr.

N71-19267*# California Univ., Riverside. Dept. of Geography.
SURFACE ENERGY EXCHANGE PHENOMENA INTERPRETED FROM IR EXPERIMENTS
Robert W. Pease *In* NASA. Manned Spacecraft Center 2d Ann. Earth Resources Aircraft Program Status Rev., Vol. 1 1969 16 p (See N71-19257 08-13)
Avail: NTIS HC $6.00/MF $0.95 CSCL 07E

The feasibility of separating multispectral images from multilayer film, utilizing techniques that have long been a part of the graphic arts, was investigated. Advantages of the separation process are: (1) The potential bank of multispectral data is greatly increased. (2) A single lens, single camera can be substituted for the more elaborate clusters. (3) Registration or congruency of images is automatic. (4) Better contrast is obtained in the green band, subject to deterioration by air luminance. A.L.

N71-19315*# Chicago Univ., Ill. Dept. of Biophysics.
HIGH VOLTAGE ELECTRON MICROSCOPY AT LIQUID HELIUM TEMPERATURES
Humberto Fernandez-Moran *In its* Electron Microscopy in Microbiol. and Lunar Rock Analysis Dec. 1970 1 p Presented at the 7th Intern. Congr. on Electron Microscopy, Grenoble, France, 30 Aug.-Sep. 1970 (See N71-19311 08-14)
Avail: NTIS CSCL 20L

Advances in cryo-electron microscopy to achieve enhanced resolution and controlled manipulation of molecular structure are reviewed. The high performance and reliability and low cost of the electron microscope are indicated. Improved liquid helium cold stage assemblies extend the temperature range to about 0.06 K, and the use of the instrument for direct electron optical observation is mentioned. N.E.N.

N71-19339 Maine Univ., Orono.
MASS TRANSFER AND DRAG COEFFICIENTS OF BUBBLES RISING IN DILUTE AQUEOUS SOLUTIONS
Delmar Richard Raymond (Ph.D. Thesis) 1969 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 70-1774

The effects of aliphatic alcohols on mass transfer and drag coefficients of a carbon dioxide bubble were investigated in the presence of minute quantities of a homologous series of alcohols. A high speed photography technique was used to provide an almost continuous record of the bubble volume, shape, and oscillation, as related to the height of the bubble in the liquid, and the time elapsed from the moment of its release. The results showed that the concentration, molecular size, and structure of the investigated alcohols have a pronounced effect on mass transfer, as well as drag, coefficients of the rising bubble. The significance of these effects with respect to idealized models of a highly circulating bubble and a solid sphere was considered, and a functional relationship was found to exist. It appears that this relationship may be applied to systems more complex than a single bubble. Dissert. Abstr.

N71-19343# California Univ., San Diego. Dept. of Physics.
LIQUID HE 3, LIQUID MIXTURES OF HE 3 AND He 4, AND DILUTION REFRIGERATION
John C. Wheatley [1970] 38 p refs
(Contract AT(04-3)-34)
(UCSD-34-P-143-29) Avail: NTIS

Basic properties of pure liquid He-3 and dilute solutions of He-3 in superfluid He-4 are reviewed as they relate to the design and operation of dilution refrigerators. Brief discussions are given both of the intrinsic limitations of the dilution refrigerator and of instabilities that can degrade performance. Characteristics of a new generation of practical dilution refrigerators are displayed and discussed. Author (NSA)

N71-19348# California Univ., Livermore. Lawrence Radiation Lab.
STABILITY IN SUPERCONDUCTING MAGNETS
C. D. Henning 20 May 1970 7 p refs Presented at the 5th Ann. Intersociety Energy Conversion Eng. Conf., Las Vegas, Nev., 21 – 25 Sep. 1970 Submitted for publication Sponsored by AEC
(UCRL-72330; CONF-700912-8) Avail: NTIS

The newest stabilization techniques are reviewed, including nucleate cooling, multifilamentation, twisting, and enthalpy stabilization. A discussion is presented of which techniques are suitable for a given application. NSA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-18151# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
THE PROCESS PION NUCLEON YIELDS omega-MESON NUCLEON AT HIGH ENERGIES
N. A. Kobylinskii 1970 9 p refs In RUSSIAN; ENGLISH summary
(ITF-70-39) Avail: AEC Depository Libraries

It is shown that the experimental data for the cross section and density matrix of the process pion nucleon yields omega-meson nucleon at 4.19 GeV require for their explanation to take into account not less than four singularities with definite quantum numbers: two with natural and two with unnatural parity. A consideration is made of the model (rho + P + B) describing a number of features of the present experimental data. A violation of the vector dominance model predictions is also noted. Author (NSA)

N71-18154# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF TRITIUM HAZARDS
Bernadette Vaubert and Robert Bittel Sep. 1970 47 p refs In FRENCH
(CEA-BIB-182; EUR-4522) Avail: AEC Depository Libraries

In this bibliography the following points were considered: nuclear characteristics, tritum production processes and resulting potential hazards; tritium behavior towards hydrogen and several hydrogenated compounds; detection and radiochemical determination; environmental transfers, with emphasis on tritium behavior in the presence of atmospheric water and in various aquifer systems; some biological considerations of absorption, inhalation, and dosimetry; and radiobiology in order to characterize effects caused by the nuclear characteristics of tritium. NSA

N71-18163# Academy of Sciences (USSR), Moscow.
COMPENSATION OF RESONANCE PERTURBATIONS IN STELLARATOR MAGNETIC FIELD
M. A. Ivanovskii and A. P. Popryadukhin 1970 23 p refs In RUSSIAN *Its* Preprint No. 118
(ND-18477) Avail: AEC Depository Libraries

Compensations of magnetic field resonance perturbations were achieved with the first type (i/2 Pi) = 1 in the Tor-2 stellarator. The two upper harmonics p = 1, q = 1, and p = 2, and q = 2 were compensated. The method of compensation is described, and plasma confinement in the resonance is studied as a function of the degree of compensation. Author (NSA)

N71-18172# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RELATIVISTIC QUASIPOTENTIAL EQUATIONS IN THE CASE OF ELECTROMAGNETIC INTERACTION
A. S. Ilchev and M. D. Mateev 1970 23 p refs
(JINR-E2-5225) Avail: AEC Depository Libraries

The quasipotential approach is applied to the systems of particles which interact electromagnetically. Two basic scattering processes – electron-positron and Compton scattering are described in detail. Author (NSA)

N71-18173# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
HYBRID PROGRAM FOR SOLVING THE SPACE-TIME DEPENDENT DIFFUSION EQUATION IN FOUR ENERGY GROUPS
D. Saphier and J. P. Merle 1970 9 p refs Presented at Conf. on Hybrid Computation, Munich, 31 Aug. – 4 Sep. 1970
(CEA-CONF-1582; CONF-700826-2) Avail: AEC Depository Libraries

A new method was developed to solve the space-time dependent diffusion equation in four energy groups and up to 100 meshpoints, with a hybrid computer. The limitations and field of application of this program, and a brief description of the Hybshov-code are given. It was found that the cost price of the resolution of a problem on a hybrid computer is lower than on a digital computer. NSA

N71-18175# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EXCHANGE QUASIPOTENTIAL FOR THE HIGH-ENERGY PION(+ OR −) PROTON-SCATTERING AND THE PROBLEM OF LINEARITY OF THE REGGE TRAJECTORIES
V. A. Matveev and L. A. Slepchenko 1970 21 p refs
(JINR-E2-5226) Avail: AEC Depository Libraries

A general integral representation for the exchange quasipotential is used. The Veneziano-like representation for the problem of the difference of the total cross sections for pion (+ or −) proton-scattering is considered. Author (NSA)

N71-18182# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INTERACTION OF 60 GeV PION(−)-MESONS WITH NUCLEONS AND NUCLEI
N. Dalzhazhav, K. D. Tolstov, and G. S. Shabratova 1970 17 p refs In RUSSIAN
(JINR-P1-5326) Avail: AEC Depository Libraries

The interaction of 60-GeV pion(-)-mesons with nucleons and nuclei was investigated using the photoemulsions enriched with hydrogen and light nuclei (C,O). It is shown that: several particles, produced in a primary and pion(-)N-collision, interact simultaneously with the subsequent nucleon of a nucleus; and coherent interactions in photoemulsion are due mainly to Ag and Br nuclei. Author (NSA)

N71-18183# Strasbourg Univ. (France). Faculte des Sciences.
CHEMICAL CONSEQUENCES OF THE NUCLEAR TRANSFORMATIONS OF XENON IN AN AQUEOUS SOLUTION OF XENON TRIOXIDE
Maurice Cassou (Ph.D. Thesis) 16 Mar. 1970 80 p refs In FRENCH
(NP-18396) Avail: AEC Depository Libraries

Aqueous solutions of Xe trioxide were irradiated in a thermal neutron flux. The low retention value and the isotopic effect observed enable highly Xe-125-enriched radioxenon to be obtained for short irradiation times. The chemical consequences of the Xe-133m yields Xe-133 transition in XeO3 were also studied, and the yield of Xe - O bond rupture was determined. The value found is equal to the transition yield by internal conversion. The experiment shows that radiochemically pure Xe-133 may be obtained from (Xe-133m)-labeled XeO3. Author (NSA)

N71-18184# European Organization for Nuclear Research, Geneva (Switzerland).
NEW DISK-LOADED WAVEGUIDES FOR THE CERN RF SEPARATOR
Ph. Bernard, H. Lengeler, and V. Vaghin 17 Sep. 1970 39 p refs
(CERN-70-26) Avail: AEC Depository Libraries

Three deflectors for the CERN RF separator have been designed and constructed. The deflection of particles will be nearly doubled compared to the situation with the old deflectors. The choice of the deflectors takes into account new experimental and theoretical results in the high power behavior of deflecting modes. New and refined methods for measurements on models, coupler matching and tuning of disk-loaded waveguides have been developed and allowed to achieve very uniform dephasings per cell and very low standing wave ratios over a frequency range of several MHz. Problems of machining and brazing in a vacuum furnace are discussed briefly. Results of a deflection test with 16 GeV protons were found to be in agreement with computer calculations and measurements on models. Author (NSA)

N71-18185# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON PROTON-WAVES OF THE PION NUCLEON-SCATTERING IN THE MODEL WITH SHORT-RANGE REPULSION
V. I. Zhuravlev and V. A. Mescheryakov 1970 20 p refs In RUSSIAN
(JINR-P2-5302) Avail: AEC Depository Libraries

A solvable model for p-waves of the pion N-scattering from the condition f sub 13 = f sub 31 = 0 is obtained. The model has an interesting peculiarity: the condition of the crossing symmetry on the matrix elements of S-matrix is inhomogeneous. The solution of the model contradict the experimental data. The reasons for this contradiction are discussed. Author (NSA)

N71-18186# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
TORSATRON WITHOUT TOROIDAL FIELD COILS AS A POSSIBLE SOLUTION TO THE DIVERTOR PROBLEM
C. Gourdon, D. Marty, E. Maschke, and J. Touche 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug - 4 Sep. 1970
(CEA-CONF-1602; CONF-700817-14) Avail: AEC Depository Libraries

A stellarator-type configuration with only helical conductors and no toroidal field coils, was investigated by numerical calculations. Interesting properties were found for the configurations with high aspect ratio (R/a approximates 10) (t up to 4, and rho/L sub s approximates or equals 1). This configuration (Torsatron) is particularly well suited for the construction of a divertor. Author (NSA)

N71-18190# Tokyo Univ. (Japan). Inst. for Nuclear Study.
QUASI-FREE ELECTRON SCATTERING ON C 12 AND Be 9
S. Hiramatsu, T. Kamae, H. Muramatsu, K. Nakamura, and K. Nishiyama et al 14 Jul. 1970 45 p refs
(INSJ-122) Avail: AEC Depository Libraries

A preliminary run testing the feasibility of quasi-free electron scattering experiments for light and medium nuclei was carried out using the external electron beam. The binding energy spectra for C-12 and Be-9 and the momentum distributions of 1s and 1p protons in C-12 and of 1p protons in Be-9 are presented. A short review of impulse approximations as applied to the quasi-free electron scattering is also included. The results agree well with that obtained by Amaldi, et al. for C-12. However, for Be-9 , they agree only poorly with (p, 2p) results. Author (NSA)

N71-18191# Gosuderstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
ON SOME PROPERTIES OF THE TOTAL CROSS SECTIONS OF INELASTIC LEPTON-HADRON PROCESSES
F. F. Tikhonin 1970 10 p refs In RUSSIAN
(IFVE-STF-70-4) Avail: AEC Depository Libraries

The possibilities of investigating the inelastic form factors of lepton-hadron scattering in a simple experiment are considered. Author (NSA)

N71-18192# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
NFLO: A FORTRAN 4 SUBROUTINE FOR ANALYSING THERMOLUMINESCENT DETECTOR DATA
J. P. Longworth Jul. 1970 20 p refs Submitted for publication
(RD/B/N-1677) Avail: AEC Depository Libraries

The NFLO calculates integrated gamma dose equivalent and thermal neutron fluence from data given by thermoluminescent detectors. The TL readings are corrected for instrument noise and sample weight variation. The exposure dose is calculated using calibration factors which may be either given or calculated by the program from other TLD readings. The thermal neutron fluence is found by correcting for gamma sensitivity and applying a further calibration factor. The NFLO is one of two subroutines used in SUMI, a code for analysing DELTA spectrometer data, but may also be used on its own. Author (NSA)

N71-18193# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PHOTON-PHOTON SCATTERING WITH COLLIDING POSITRON-ELECTRON BEAMS
Z. Kunszt, R. M. Muradyan, and V. M. Ter-Antonyan 1970 20 p refs
(JINR-E2-5347) Avail: AEC Depository Libraries

Photon-photon forward scattering is discussed by studying the annihilation process positron + electron yields gamma + hadrons. Using automodality, vector meson dominance and the parton model a rough estimate is given of the deep inelastic cross section showing that it might be comparable to the cross section of the deep inelastic reaction positron + electron yields H + anything, H being a singled out hadron. Some of the one meson contributions are calculated in the quark model. Author (NSA)

N71-18194# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
PARTICLE REBUNCHING BY AN ADDITIONAL LOWER FREQUENCY RF SYSTEM IN ELECTRON STORAGE RINGS
R. D. Kohaupt Aug. 1970 29 p refs
(DESY-70/34) Avail: AEC Depository Libraries

In the energy region where the storage ring luminosity is limited by the available power and the natural beam size, it is proportional to the population number. The change of the population

number with an additional rf system of lower frequency is discussed. The rebunching mechanism is investigated with respect to beam lifetime and efficiency. Author (NSA)

N71-18195# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

ON THE POSSIBILITY OF STUDYING THE DIFFERENCE BETWEEN PROTON AND NEUTRON DISTRIBUTIONS IN NUCLEI BY QUASI-FREE SCATTERING REACTIONS

N. M. Kabachnick 8 Sep. 1969 12 p refs

(ISS-69/34) Avail: AEC Depository Libraries

The difference in the momentum distributions thus obtained can be related to the difference in radii of the proton and neutron distributions through the uncertainty principle. For A less than or equal to 40, this difference is probably beyond present experimental techniques. For heavier nuclei, there is certainly a difference in the momentum distributions of protons and neutron since they fill different shells. This leads to different forms of the momentum distributions, even with the same radii for the two potential wells. A reasonable difference in the radii of these wells has the effect of changing the momentum distributions by the same order of magnitude as the difference due to the filling of different shells. Therefore, from the existence of an experimental difference in the momentum distributions, it will be very hard to conclude that protons and neutrons fill wells of different radii. To decide this one must use some model; thus, the result becomes strongly model-dependent. NSA

N71-18196# FIAT S.P.A., Turin (Italy). Sezione Energia Nucleare.

PROGRAM OF RESEARCH COMPLETED AT THE E. FERMI FACILITY Progress Report, Jan. – Mar. 1969

Mar. 1969 21 p

(Contract EURATOM-098-66-6-TEEI)

(FN-E-109; PR-10) Avail: AEC Depository Libraries

The quarter's activity was devoted principally to testing the new monodimensional burnup code SQUIRREL and to calculations with the SQUID code in bidimensional geometry. The results of the burnup calculations made with the SQUIRREL code for the core of Trino Vercellese reactor are presented. The axial power distributions obtained were compared with the results obtained previously using the MELE code and the Aeroball profile. Also the radial distribution of the short-lived activations was calculated with the SQUID code and compared with the experimental data. Author (NSA)

N71-18198# Deutsches Electronen-Synchrotron, Hamburg (West Germany).

NEUTRAL PION-ELECTROPRODUCTION AT DELTA(1236) AND AT FOUR MOMENTUM TRANSFER OF 15/f sq

W. Albrecht, F. W. Brasse, and H. Dorner Aug. 1970 13 p refs

(DESY-70/36) Avail: AEC Depository Libraries

The electroproduction of the Delta(1236) was investigated through the neutral pion channel at a four momentum transfer of 15/f sq. Angles and momenta of the secondary electron and of the proton were measured in coincidence to obtain the differential cross section for the reaction electron + proton yields electron + proton + neutral pion. The angular distribution for s and p waves of the outgoing pion and nucleon in their center-of-mass system was fitted to the cross sections. The resultant coefficients of the angular distributions are given as functions of the mass W of the pion nucleon system for 15/f sq. In a small range of W around the resonance the contributions of the resonant multipoles M(1+), E(1+), and S(1+) to the cross section are also given. Author (NSA)

N71-18199# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

INELASTIC INTERACTIONS OF PARTICLES AND NUCLEI AT HIGH AND SUPERHIGH ENERGIES

V. S. Barashenkov, A. S. Il'inov, and V. D. Toneev 1970 38 p refs Submitted for publication

(JINR-E2-5282) Avail: AEC Depository Libraries

The methods and the results of the cascade calculations of inelastic interactions of particles and nuclei in the energy range from several dozens of MeV to several thousands of GeV are discussed. Special attention is paid to the cases in which the calculations performed by the usual cascade model are in disagreement with experiment. Various ways of improving the theory are considered, in particular, the account of the change of the nuclear density as the cascade particle shower develops. Author (NSA)

N71-18200# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.

ON THE EQUALITY OF THE TOTAL CROSS SECTIONS FOR THE INTERACTION OF PARTICLES AND ANTIPARTICLES AT HIGH ENERGIES

G. G. Volkov 1969 11 p refs In RUSSIAN

(IFVE-STF-69-110) Avail: AEC Depository Libraries

Physical conditions of violation and fulfillment of the Pomeranchuk theorem are presented. Author (NSA)

N71-18201# Forsvarets Forskningsanstalt, Stockholm (Sweden).

EXPERIMENTAL TECHNIQUES FOR TRACER ELEMENT ANALYSIS

L. H. Andersson and R. Soederlund Jun. 1970 22 p refs In SWEDISH

(FOA-4-4432) Avail: AEC Depository Libraries

Experimental procedures and equipments aimed to reduce the contamination to acceptable levels are described. The applications are concentrated on spectrochemical trace analysis of plutonium-containing samples. NSA

N71-18202# Lyon Univ., France. Inst. de Physique Nucleaire.

THEORETICAL ANGULAR DISTRIBUTIONS AND POLARIZATIONS IN THE THREE-BODY PROBLEM

C. Fayard, G. H. Lamot, E. El Baz, J. Pigeon, J. Barguil et al Jul. 1970 29 p refs

(LYCEN-7046) Avail: AEC Depository Libraries

The aim was to determine the angular distribution or the polarization of the emerging particle in the three body problem using the Faddeev equations. A simplification is obtained if nonlocal separable potentials are used and thus the Faddeev – Lovelace formalism seems more adequate. A complete angular momentum reduction of the Faddeev – Lovelace equations based on the procedure described by Stingl and Finat is given and the angular distribution and the polarization of the emerging particles are derived. The special cases usually described are shown to be easily obtained. For example, the result for (neutron, deuteron) three body elastic scattering is given. NSA

N71-18203# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

EXPANSION OF THE INVARIANT TWO-POINT FUNCTION FOR THE BILOCAL FIELD OF THE LORENTZ, POINCARE AND O(4,1) (O(3,2)) GROUPS

D. I. Blokhintsev and R. P. Zaikov 1970 20 p refs In RUSSIAN

(JINR-P2-5304) Avail: AEC Depository Libraries

The two-point function for the bilocal field was expanded in the unitary representations of the Lorentz, Poincare and O(4,1) (O(3,2)) groups. This expansion was performed in the functions

given on the two-sheet, one-sheet hyperboloid or on the cone, respectively. In this way the expansion was obtained for the invariant scattering amplitude of two scalar particles out of the mass surface. Author (NSA)

N71-18204# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.

PSEUDOSTATISTICAL TIME-OF-FLIGHT METHOD FOR SCATTERING EXPERIMENTS WITH SLOW NEUTRONS [DIE PSEUDOSTATISTISCHE FLUGZEITMETHODE FUER STREUEXPERIMENTE MIT LANGSAMEN NEUTRONEN]

Folker Gompf (Ph.D. Thesis--Tech. Hochschule, Karlsruhe, West Germany) Apr. 1970 60 p refs In GERMAN; ENGLISH summary (KFK-1126) Avail: AEC Depository Libraries

A description of an improved time-of-flight method for scattering experiments with slow neutrons is presented. Instead of pulsing the continuous reactor beam periodically, the neutrons are now pseudostatistically modulated by a neutron chopper. In comparison with the classical time-of-flight method, where the time utilization of the reactor beam is smaller than 1%, it is now raised to 50%. It is shown that a statistical chopper is advantageous in those cases where the time-of-flight spectrum consists of a number of peaks which have amplitudes larger than the average amplitude. The method is also advantageous in all cases where the background is very high. A spectrometer for pseudostatistical time-of-flight measurements was built to be used for elastic and inelastic neutron scattering experiments. Investigations on the structure of BiFeO3 and on phonons in Ag and Au are described that were not feasible before because of low neutron intensity. Author (NSA)

N71-18205# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.

EMPIRICAL METHOD FOR CALCULATION OF THE ENERGY STRAGGLING IN THE SLOWING DOWN OF IONIZING PARTICLES [EINE EMPIRISCHE METHODE ZUR BESTIMMUNG DES ENERGIE-STRAGGLING BEI ABBREMSUNG IONISIERENDER TEILCHER]

I. Schouky, E. Seibt, and Ch. Weddigen Apr. 1970 16 p refs In GERMAN; ENGLISH summary (KFK-1173) Avail: AEC Depository Libraries

An empirical method is described to calculate the energy straggling for heavy ionizing particles. The application of this method involves an absorber-independent relative range straggling 2 Delta R/R (where R is the mean range) in addition to the usual differential energy loss and particle range. Author (NSA)

N71-18206# Aktiebolaget Atomenergi, Studsvik (Sweden).

TABLE OF HALF-LIVES FOR EXCITED NUCLEAR LEVELS

Sven G. Malmskog Jul. 1970 32 p refs (AE-400) Avail: AEC Depository Libraries

The knowledge of the half-lives of excited states is often a valuable information in the investigation of the nuclear level structure. The present paper contains a collection of such half-lives being published in the current literature over the period 1967-1970. The data are arranged in increasing order of mass number. NSA

N71-18207# Institute of Nuclear Sciences, Lower Hutt (New Zealand).

[NUCLEAR PHYSICS RESEARCH, RADIATION RESEARCH, ISOTOPE GEOCHEMISTRY, CARBON-14 AND VARIATIONS, ISOTOPE APPLICATIONS, AND INSTRUMENT DEVELOPMENT] Progress Report, Jan.-Jun. 1969

Jun. 1969 53 p refs (NP-18408; INS-388; PR-13) Avail: AEC Depository Libraries

Progress in nuclear physics research, radiation research, isotope geochemistry (stable isotopes), carbon-14 and carbon-14 variations, isotope applications, and instrument development is outlined. NSA

N71-18212# Deutsches Electronen-Synchrotron, Hamburg (West Germany).

VECTOR MESON DOMINANCE IN PHOTO- AND ELECTROPRODUCTION

D. Schildknecht Jul. 1970 37 p refs (DESY-70/31) Avail: AEC Depository Libraries

The talk given at the Recontre de Moriond is reviewed. Recent developments are stressed, and reference is made to last years talks on the VDM in photoproduction for additional material. Author (NSA)

N71-18222# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.

PROGRAM FOR CALCULATION OF PHOTOPRODUCTION OF SINGLE PIONS FROM NUCLEONS

M. Nigro, P. Spillantini, and V. Valente 14 Oct. 1969 13 p refs *Its* Note No. 453 (LNF-69/59) Avail: AEC Depository Libraries

A program was developed for the general case of the calculation of the magnitudes (cross section, production asymmetry, polarization of the recoil nucleon, etc.) in the single production of pions from nucleons. The development of the program is outlined. The logical block scheme and the list of the program is given together with a description of the input data and its use. An example is given of the use of the program. NSA

N71-18223# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

PROPERTIES OF SUPER-PROPAGATORS IN LAGRANGIAN QUANTUM-FIELD THEORY WITH EXPONENTIAL INTERACTIONS

Michael Karowski Jul. 1970 40 p refs In GERMAN; ENGLISH summary (DESY-70/30) Avail: AEC Depository Libraries

The super-propagator for any mass in a field theory with an exponential interaction Lagrangian is defined. Several integral representations are derived. The analytic properties with respect to the coupling constant and the asymptotic behavior in momentum space are investigated. Author (NSA)

N71-18224# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.

T-INVARIANCE IN ELECTRON-DEUTERON ELASTIC SCATTERING

S. Ferrara and A. F. Grillo 19 May 1970 5 p *Its* Note No. 476 (LNF-70/20) Avail: AEC Depository Libraries

It has been suggested that polarization in e-d scattering can be present in the absence of T-violation in the electromagnetic interaction if there is a phase between the S and D states of the deuteron. It is shown that, in the impulse approximation, time-reversal invariance in the electromagnetic transition of the deuteron implies that the phase is 0 to 180 deg. Since the recoil deuteron polarization is proportional to tan delta sub SD, it is concluded that the presence of the vector polarization of itself implies a T-violation in the electromagnetic transition. NSA

N71-18225# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.

NUMERICAL CALCULATIONS ON THE SMALL ANGLE SCATTERING LUMINOSITY MONITOR USED AT ADONE

H. C. Dehne and M. Preger 13 Jul. 1970 38 p refs *Its* Note No. 485
(LNF-70/33) Avail: AEC Depository Libraries

Numerical calculations of the dependence of the small angle e(+)e(−) scattering cross section on the source displacements are presented. The results of these calculations can be used to determine the sensitivity of the luminosity measurement to displacements of the source and to check the internal consistency of the measurements. The counter telescopes, displacements of the interaction region, simultaneous displacements, internal consistency, and counter positioning are discussed. NSA

N71-18226# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
INVESTIGATION OF THE ANGULAR CORRELATION IN THE THREE-NUCLEON REACTION dp YIELDS ppn
H. Brueckmann, W. Kluge, H. Matthaey, L. Schaenzler, and K. Wick Jun. 1970 13 p Presented at the Meeting of the Am. Phys. Soc., Washington, D.C., Apr. 1970
(KFK-1216; CONF-700419-3) Avail: AEC Depository Libraries

The reaction d + p yields p + p + n was investigated by kinematically complete experiments at a deuteron bombarding energy of 52.3 MeV. The aim of a systematic study was to explore the contribution of n-p and p-p FSI at many pairs of angles. The data were analyzed using the Watson−Migdal theory. The n-p and p-p scattering lengths and the cross sections for the production of the FSI-pairs in singlet and triplet states were extracted. The scattering lengths obtained were found to be in good agreement with the values known from free nucleon−nucleon scattering. The resulting angular distributions of the singlet and triplet cross sections turn out to be quite different. The close relation between the angular distribution for the triplet cross section and in the angular distribution for the triplet cross section and the angular distribution of d-p elastic scattering is discussed. In separate runs kinematics were changed in order to obtain the angular distribution of the FSI-pairs in their cm-system. Author (NSA)

N71-18231# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
OBSERVATION OF COHERENT INTERFERENCE PATTERN BETWEEN rho, omega DECAYS
H. Alvensleben, U. Becker, and William K. Bertram Aug. 1970 10 p refs
(DESY-70/40) Avail: AEC Depository Libraries

A high statistics experiment measuring the structure of positron electron mass spectrum from photoproduction of rho and omega mesons is reported. At 5.1 GeV, based on 4000 events, analysis of the spectra yields a ratio of vector meson photon coupling constants. Author (NSA)

N71-18232# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INVESTIGATION OF HALF-LIVES OF 2(+) AND 4(+) LEVELS OF THE MAIN AND ROTATIONAL BAND IN EVEN-EVEN NUCLEI OF Os, Er, Dy
V. A. Morozov, T. M. Muminov, and A. B. Khalikulov 1970 15 p refs In RUSSIAN
(JINR-P6-5201) Avail: AEC Depository Libraries

The half lives are measured for the first excited levels 2(+) and 4(+) in the nuclei Dy-156(T sub 1/2(2+) = 0.90 + or − 0.08 nsec), Dy-158 (T sub 1/2(2+) = 1.63 + or − 0.08 nsec), Dy-160(T sub 1/2(2+) = 0.90 + or − 0.80 nsec), Dy-158(T sub 1/2(2+) = 1.63 + or 0.08 nsec), Dy-160(T sub 1/2(2+) = 1.76 + or − 0.08 nsec), T sub 1/2 (4+) = 95 + or − 10 nsec), Er-162(T sub 1/2(2+) = 1.17 + or − 0.10 nsec), Er-164(T sub 1/2(2+) = 1.48 + or − 0.08 nsec), Er-166 (T sub 1/2(2+) = 1.99 + or − 0.09 nsec), T sub 1/2(4+) = 111 + or − 10 nsec), and Os-184 (T sub 1/2(4+) = 46 + or − 13 nsec). Author (NSA)

N71-18233# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
RADIONUCLIDE DETERMINATION BY THE SUCCESSIVE SHORT SAMPLING METHOD. APPLICATION TO MEASUREMENT OF THE CONCENTRATION AND DISEQUILIBRIUM OF RADON DECAY PRODUCTS IN FREE AND CONDITIONED ATMOSPHERES [LE DOSAGE DES RADIONUCLEIDES PAR LA METHODE DES PRELEVEMENTS SUCCESSIFS DE COURTE DUREE APPLICATION A LA MESURE DE LA CONCENTRATION ET DU DESEQUILIBRE DES DESCENDANTS DU RADON DANS LES ATMOSPHERES LIBRES ET CONDITIONEES]
Claude Lasseur (Ph.D. Thesis−Toulouse Univ.) Aug. 1970 158 p refs In FRENCH
(CEA-R-4048) Avail: AEC Depository Libraries

The decay equations were studied and the sampling and measurement parameters of the apparatus determined. The decay processes were studied using capillary membranes and the penetration of aerosols in the membranes was determined by a Monte Carlo method. A description of the apparatus and its calibration and operation are given. The experimental work consistec of: a study of the Rn-RaA radioactive decay and the corresponding equilibrium state; the measurement of the concentration and the disequilibrium in the atmosphere near to the ground for each short lived daughter of the radon decay chain. The effect of local weather factors is discussed. The measurement of the concentration and disequilibrium of each daughter of radon in conditioned atmospheres including laboratory, uranium mines, and reactor buildings is discussed. (NSA)

N71-18238# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
SCATTERING OF SLOW NEUTRONS BY ORTHOHYDROGEN
L. Olivi 23 Apr. 1970 20 p refs
(EUR-4496-e) Avail: AEC Depository Libraries

The differential and total slow-neutron scattering cross sections of orthohydrogen were derived by taking into account the removal of the degeneracy of the rotational states of the molecule. The result shows that the cross sections depend on the direction of quantization, as is expected. A numerical calculation for application was performed in some typical cases, and the result is shown graphically. Author (NSA)

N71-18239# Commissariat a l'Energie Atomique, Limeil-Brevannes (France). Centre d'Etudes.
STUDY OF A LOCAL AND NONSINGULAR NUCLEON-NUCLEON FORCE IN THE FRAMEWORK OF THE HARTREE-FOCK THEORIES [ETUDE D'UNE FORCE NUCLEON-NUCLEON LOCALE ET NON SINGULIERE DANS LE CADRE DES THEORIES HARTREE-FOCK]
D. Gogny and P. Pires (Paris Univ., Orsay) 1970 29 p refs In FRENCH Presented at the AUSSOIS Seminar, Feb. 1970
(CEA-CONF-1568) Avail: AEC Depository Libraries

Among the potentials that can reproduce the data of the two body problem one potential was sought, which when used in conjunction with the Hartree−Fock theory would reproduce some of the properties of finite nuclei. The general plan of studies was: the nucleon−nucleon interaction, the study of the two body problem, the Hartree−Fock theory (formalism, symmetry and choice of a representation, and practical methods), nuclear matter, and the testing of the nucleon−nucleon interaction. The results concerning a particular potential are presented and discussed. Author (NSA)

N71-18240# Joint Inst. for Nuclear Research, Dubna (USSR).
SEARCH FOR THE DOUBLET STRUCTURE OF MESON RESONANCES USING THE FOURIER ALGORITHM

V. M. Dubovik, B. L. Markovskii, L. M. Soroko, and T. A. Strizh 1970 28 p refs In RUSSIAN
(JINR-P1-5340) Avail: AEC Depository Libraries

The experimental data on the meson resonances A sub 2, K*(1420) and rho sub 0 are analyzed anew using the Fourier algorithm. In the information region of the energy frequencies the minima are absent which can be interpreted as the proof of the doublet structure of K*(1420) and rho sub 0 resonances. The location of the boundary between the information and informationless regions in the energy-frequency scale determined the real resolution of missing mass spectrometer. Author (NSA)

N71-18246# Deutsches Electronen-Synchrotron, Hamburg (West Germany).
PHOTOPRODUCTION OF OMEGA MESONS FROM NUCLEI
P. L. Braccini, C. Bradaschia, R. Castaldi, L. Foa, and K. Luebelsmeyer et al Jul. 1970 19 p refs
(DESY-70/33) Avail: AEC Depository Libraries

An experiment of omega meson photoproduction from nuclei (C, Al, Zn, Ag, Ta, and Pb at 5.7 GeV mean photon energy) is reported. The experimental apparatus detects the pion(0) gamma decay of the produced omega mesons. Results concerning the omega meson-photon coupling and concerning the omega meson-nucleon total cross section sigma sub omega are derived. The dependence of these results on the different possible models of analysis is discussed. Author (NSA)

N71-18247# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ANNIHILATION OF ELECTRON-POSITRON PAIRS INTO MESONS
G. Kramer, J. L. Uretsky, and T. F. Walsh Sep. 1970 18 p refs
(DESY-70/44) Avail: AEC Depository Libraries

Hadronic cross sections for e(+)e(-) annihilation in the multi-GeV energy region are estimated. The model invokes rho meson dominance and the known couplings of the physical rho meson to resonances. It is concluded that the cross section at 2-GeV total energy could be comparable to the cross section for producing muon(+)muon(-) pairs. An attempt is also made to estimate a cross section from statistical model. Author (NSA)

N71-18248# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
USE OF A SMALL DIGITAL COMPUTER FOR AGR OPERATIONAL CHANNEL POWER CALCULATIONS
R. C. Bending Jul. 1970 17 p refs Submitted for publication
(RD/B/N-1749) Avail: AEC Depository Libraries

The principles of using a small digital computer to calculate the axially-averaged two energy group neutron fluxes and channel powers in an advanced gas-cooled reactor for any fuel loading are presented. It is demonstrated that the system is feasible and shows a cost advantage over other calculational methods. A specification is made for a complete system. Author (NSA)

N71-18249# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
AVERAGE ENERGY EMITTED BY UNSTABLE NEGATIVE BETA NUCLIDES [ENERGIE MOYENNE EMISE PAR LES NUCLEIDES NEGATIVE BETA INSTABLES]
Bertrand Barre and Roland de Tourreil Apr. 1970 36 p refs In FRENCH
(CEA-N-1285) Avail: AEC Depository Libraries

A code for calculating the average energy of an allowed negative beta transition, or the average energy of an allowed negative beta disintegration spectrum is described. Two versions of this code are given: Univac 1108 and IBM 360 versions. The energy spectrum of a negative beta transition is integrated from a tabulation of the Fermi functions; the energy emitted as gamma radiation is obtained by difference. Author (NSA)

N71-18262# Paris Univ., Orsay (France). Faculte des Sciences.
RESEARCH INTO HEAVY RESONANCES IN THE REACTION ANTIPROTON PROTON YIELDS 3 PION (+) 3 PION (-) PION (0) AT 3.6 GeV/c [RECHERCHE DES RESONANCES LOURDES DANS LES INTERACTIONS ANTIPROTON PROTON DONNE 3 PION(+) 3 PION(-) PION(0) A 3.6 GeV/c]
Tchiu-Pung Yiou (Ph.D. Thesis) 22 May 1970 103 p refs In FRENCH
(NP-18466) Avail: AEC Depository Libraries

Heavy resonances in the antiproton proton yields 3 pion(+) 3 pion(-) and the antiproton proton yields 3 pion(+) 3 pion(-) pion(0) reactions at 3.6 GeV/c were investigated. Serious difficulties were encountered in the analysis of the experimental results because of the background noise produced by large numbers of particles observed in the final state. In spite of this, from the extensive data obtained, numerous heavy mesonic resonances were found and precise information about their modes of disintegration obtained. The signals observed were weak, but they all corresponded to the masses associated with recently discovered resonances. The predictions of the Regge pole model and certain quark models were confirmed. NSA

N71-18285# Lyon Univ. (France). Inst. de Physique Nucleaire.
A CONTRIBUTION TO THE STUDY OF THE Si 28(d,p) Si 29 REACTORS AT LOW ENERGIES (1 TO 3 MeV) [CONTRIBUTION A L'ETUDE DES REACTIONS Si 28(d,p)Si 29 A BASSES ENERGIES (1-3 MeV)]
Etienne Descroix (Ph.D. Thesis) 6 Mar. 1970 57 p refs In FRENCH
(LYCEN-7013) Avail: AEC Depository Libraries

The Si-28(d,p)Si-29 reactions between 1 and 3 MeV were studied at low energies. The equipment used, the detection system, and the associated electronics were described in detail. In order to interpret the results theoretically, it was necessary to study in parallel the elastic scattering of the deuterons by Si, and obtain the input parameters of the optical model. Agreement between the experimental curve and the theoretical curve was only possible for the higher energies (2.8 to 3 MeV), and the two first levels. The difficulty appears to arise from the compound nucleus, whose fluctuating and asymmetric character was revealed by the experimental curves. Author (NSA)

N71-18290# Brandeis Univ., Waltham, Mass. Dept. of Physics.
THEORETICAL RESEARCH IN QUANTUM OPTICS Final Report, 15 Sep. 1967 - 14 Sep. 1970
Hugh N. Pendleton Dec. 1970 10 p refs
(Contract F19628-68-C-0062)
(AD-715309; AFCRL-70-0571) Avail: NTIS CSCL 20/10

Theoretical studies have been made of the normal photodetection process, of the attenuation of electromagnetic wave trains passing through media suitable for photodetection, and of the behavior of photosensitive atoms in the presence of very intense electromagnetic fields. The process of two-photon absorption by single atoms was related to the correlation functions describing the propagating electromagnetic field. The dependence of spontaneous emission on the separation of radiating atoms was determined. The effect of an expanding laser cavity on enclosed radiation was studied. The problems of rotating spin systems and of the statistics of parametrically coupled oscillators were analyzed. Author (GRA)

N71-18291# Joint Inst. for Nuclear Research, Dubna (USSR).
A TEST OF MODELS FOR THE ASYMPTOTIC BEHAVIOUR OF THE KAON(+ OR −) PROTON SCATTERING AMPLITUDES
O. V. Dumbrais and N. M. Queen 1970 6 p refs
(JINR-E2-5227) Avail: AEC Depository Libraries

Many different models have recently been proposed to explain the Serpukhov data on the K(−)p total cross section above 20 GeV, so that considerable ambiguity remains in the theoretical description of K(+ or −)p scattering at high energies. It is shown that a simple finite energy sum rule provides a strong consistency test of models for the asymptotic behavior of the amplitudes. In particular, the hypothesis that the K(+ or −)p total cross sections have reached their asymptotic limits at 20 GeV can be ruled out by the sum rule. Author (NSA)

N71-18292# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
COMPARISON OF NEW DATA ON PROTON-PROTON ELASTIC SCATTERING AT 15 TO 30 GeV/c WITH CALCULATIONS BASED ON THE MODEL OF THE DISCRETE VALUES OF ROOT MEAN SQUARE TRANSVERSAL MOMENTA
K. D. Tolstov 1970 9 p refs
(JINR-E1-5219) Avail: AEC Depository Libraries

It is shown that the experiment data on elastic p-p scattering at 15, 20 and 30 GeV/c agree well with the calculations based on the discrete values of root-mean-square transversal momenta. Author (NSA)

N71-18297# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
WEIGHTING AND BIAS IN A MONTE CARLO CALCULATION FOR NEUTRONS IN THE CASE OF DEEP PENETRATION [PONDERATION ET BIAISAGES D'UN CALCUL DE MONTE-CARLO POUR LES TRES GRANDES PENETATIONS]
Jeanne-Marie Lanore Sep. 1969 17 p refs In FRENCH Presented at the Natl. Meeting on Digital Analysis, Bordeaux, Sep. 1969
(CEA-CONF-1567; CONF-690963-2) Avail: AEC Depository Libraries

From the solution of an equation associated with the transport equation a weighted biased system was established which allows a constant variance to be calculated for every point in phase space using a Monte Carlo method. A rigorous solution is obtained for a particular case and almost rigorous solutions are obtained for the general case. The spectra of neutrons far from their source were determined. Author (NSA)

N71-18298# Bhabha Atomic Research Centre, Bombay (India).
VAN DE GRAAFF LABORATORY Progress Report
T. P. David, comp. 1970 42 p refs
(BARC-459) Avail: AEC Depository Libraries

The operation and utilization of the 5.5 MeV Van de Graaff accelerator at Trombay during the period from July 1, 1968, to Dec. 31, 1969, are summarized. Research and instrumentation development are outlined. NSA

N71-18300# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
ANALYSIS OF THE HELICITY AMPLITUDES IN REACTIONS PION(+) PROTON , YIELDS NUCLEON RESONANCE RHO-MESON(0) AND PION(+) PROTON YIELDS NUCLEON RESONANCE OMEGA-MESON
I. M. Gramenitskii, R. Lednicki, A. M. Moiseev, A. Prokes, L. A. Tikhonova et al 1970 12 p refs In RUSSIAN
(JINR-P1-5236) Avail: AEC Depository Libraries

The angular distributions of the resonance decay products in reactions positive pion proton yields nucleon resonance neutral rho-meson and positive pion proton yields nucleon resonance omega-meson at 2.34 GeV/c were studied. Density matrices for these reactions were expressed in terms of the 12 independent helicity amplitudes. The analysis was made at small scattering angles theta sub s, that correspond to the small contribution of the amplitudes proportional to (sin theta sub s/2) to the nth power, where n = 1,2 and 3. The results were compared with the additivity quark model predictions. Author (NSA)

N71-18301# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ELECTROMAGNETIC PROTON FORM FACTORS AT SQUARED FOUR-MOMENTUM TRANSFERS BETWEEN 1 AND 3 (GeV/c)SQ
W. Bartel, F.-W. Buesser, W.-R. Dix, R. Felst, D. Harms et al Aug. 1970 13 p refs
(DESY-70/42) Avail: AEC Depository Libraries

Electron-proton elastic scattering cross sections were measured at four-momentum transfers between 1.0 and 3.0 (GeV/c) squared, and at electron scattering angles between 10 and 20 deg and at about 86 deg in the laboratory. The proton electromagnetic form factors G sub E and G sub M were determined. The results indicate that G sub E(q squared) decreases faster with increasing q squared than G sub M(q squared). Author (NSA)

N71-18303# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ELF PROGRAM [PROGRAMME ELF]
Francois Gervaise Sep. 1969 12 p ref In FRENCH Presented at the Natl. Meeting on Digital Analysis, Bordeaux, Sep. 1969
(CEA-CONF-1565; CONF-690963-1) Avail: AEC Depository Libraries

The ELF program is a polykinetic study of neutron propagation using a Monte Carlo method and cross section data available from the AWRE library program. The W normality test is used to avoid setting-up difficulties. Author (NSA)

N71-18305# Toulouse Univ. (France). Faculte des Sciences.
STUDY OF ATMOSPHERIC IONS BY MASS SPECTROMETRY [ETUDE DES IONS ATMOSPHERIQUES PAR SPECTROMETRIE DE MASSE]
Irenee Alet (Ph.D. Thesis) 1970 85 p refs In FRENCH; ENGLISH summary
(NP-18409) Avail: AEC Depository Libraries

An apparatus for the study of ions created at high pressures of 10 to 200 torr was developed. The nature of the positive ions created in atmospheric air at pressures from 10 to 200 torr by a glow discharge or by alpha irradiation with polonium 210 was investigated. Clustering phenomena revealed in the mobility experiments could be observed. From the ions observed for a high ratio, various stable clusters were formed. The part played by various organic impurities in the clustering phenomena was studied. NSA

N71-18308# Los Alamos Scientific Lab., N. Mex.
LASL CONTRIBUTIONS TO THE THIRD INTERNATIONAL SYMPOSIUM ON POLARIZATION PHENOMENA IN NUCLEAR REACTIONS
Gerald G. Ohlsen, comp. Jul. 1970 98 p refs Conf. held at Madison, Wis., 31 Aug.–4 Sep. 1970
(Contract W-7405-eng-36)
(LA-4465; CONF-700811) Avail: NTIS

Summaries of reports are presented on the following areas of research: elastic scattering of helium and elementary particles;

helium deuteron and tritium deuteron reactions; polarized sources and beams; polarization measurements; formalisms for polarization transfer; tensol analysis; and related studies. N.E.N.

N71-18320# California Univ., Livermore. Lawrence Radiation Lab.
COLLIMATION OF FAST NEUTRONS
Edward M. Lent 20 Apr. 1970 20 p refs Sponsored by AEC
(UCRL-50857) Avail: NTIS

Collimator systems were designed to enable measurement of the neutron spectra from nuclear devices. Various aspects of shielding and wall scattering are discussed, and relationships are presented to define collimator response to extended sources. A collimator system designed on the basis of the principles set forth has been used successfully in a field test. Author (NSA)

N71-18321# California Univ., Santa Barbara.
NUCLEAR STRUCTURE RESEARCH Progress Report, Task A
Robert M. Eisberg Sep. 1970 30 p refs
(Contract AT(04-3)-34)
(UCSB-34p144-7) Avail: NTIS

The completion of a set of measurements of the binding energies of proton hole states in 1f7/2 nuclei is reported. These measurements used a modification of equipment developed for earlier Y-89(p,2p) angular correlation experiments at the cyclotron. This equipment will be used for additional (p,2p) experiments if the energy resolution in the new beam area of the cyclotron proves to be as good as predicted. Also reported are measurements of the effect of nuclear reactions in the response of solid state detectors, and the development of a very successful new technique to overcome the serious experimental difficulties due to nuclear reactions in such detectors. The first use of the new technique will be to make measurements of inelastic proton scattering at very small angles. The equipment that has been constructed for the purpose is described. Author (NSA)

N71-18322# California Univ., Livermore. Lawrence Radiation Lab.
THE BETA-gamma (CP) CORRELATION MEASUREMENTS IN ALLOWED TRANSITIONS
S. D. Bloom 31 Jul. 1970 39 p refs Presented at the Intern. Conf. on Angular Correlations, Delft, The Neth. Sponsored by AEC
(UCRL-72624; CONF-700807-4) Avail: NTIS

The results which have been achieved by applying the technique of beta-gamma(CP) correlation to allowed beta decays are reviewed. It is assumed that all questions regarding the nature of the beta interaction are well understood. The beta-gamma(CP) technique has been reasonably useful in spin assignment and the measurement of electromagnetic multipole mixing; a table of nuclides for which such information has been obtained is given. The technique has also been a major factor in advancing empirical knowledge of isospin in bound nuclear states by leading to a determination of the absolute value of the Fermi matrix element, which can be interpreted as denoting an isospin impurity. NSA

N71-18323# Atomic Energy Commission, New Brunswick, N.J.
ANALYSIS OF ELEMENTAL BORON
Morris W. Lerner 1970 125 p refs
(TID-25190) Avail: NTIS

Methods for determination of boron and its impurities are reviewed. Topics covered include: standards; dissolution of elemental boron and boron carbide; separations, losses, and contamination; determination of boron; isotopic analysis; impurities in elemental boron; determination of C, O, N, and H; emission spectrographic determinations of impurities; flame-emission and atomic-absorption spectroscopic determination of impurities; X-ray spectrographic determination of impurities; polarographic determination of impurities; spark-source mass-spectrographic determination of impurities; neutron-activation determination of impurities; spectrophotometric determination of impurities; and a cooperative boron-analysis study. NSA

N71-18329# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
SMALL-DISTANCE BEHAVIOUR IN FIELD THEORY
K. Symanzik Sep. 1970 19 p refs Presented at the Summer Inst. in Theoret. Phys. (Strong Interaction Phys.), Heidelberg, Jul. 1970
(DESY-70/43) Avail: AEC Depository Libraries

The small-distance behavior in quantum field theory in the sense of overall scaling is studied with the help of the infinitesimal operation to mass vertex insertion into the Lagrangian density. This method, which depends only on power counting, is more direct than previous methods. As a by-product the method leads to as complete a description of the breaking of scale invariance as can be obtained using formal theory only. NSA

N71-18330# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
DETERMINATION OF THE PHOTOPRODUCTION PHASE OF NEUTRAL RHO-MESONS
H. Alvensleben, U. Becker, M. Chen, K. J. Cohen, T. M. Kassel et al Aug. 1970 11 p refs
(DESY-70/39) Avail: AEC Depository Libraries

Large-angle electron-positron pairs from the reaction gamma + Be yields Be + e(+) + e(-) were measured in the e(+)e(-) invariant mass region of 610 < m < 860 MeV/sq c. The phase of the photoproduction amplitude of the rho meson at 4.1 to 6.1 GeV was found to deviate from pure imaginary by 11.8 + or - 4.4 deg which corresponds to a ratio of the real to imaginary rho-nucleon amplitude of B = 0.2 + or - 0.1. Author (NSA)

N71-18331# Stanford Univ., Calif. High Energy Physics Lab.
INELASTIC ELECTRON SCATTERING FROM SEVERAL Ca, Ti AND Fe-ISOTOPES
J. Heisenberg, J. S. McCarthy, and I. Sick Nov. 1970 29 p refs Sponsored in part by NSF
(Contract Nonr-225(67))
(AD-715647; HEPH-642) Avail: NTIS CSCL 20/8

The differential cross sections for inelastic electron scattering from 40Ca, 42Ca, 44Ca, 46Ti, 48Ti, 50Ti, and 56Fe have been measured. The cross sections for the strongely excited positive 2, negative 3, positive 4, and negative 5 levels have been measured over a range of momentum transfer q of 0.4 - 2.6 (fm sup (-1)). The data have been fitted using two representations for the transition charge, (1) the hydrodynamic liquid drop, and (2) a phenomenological model. Author (GRA)

N71-18332# Toulouse Univ. (France). Faculte des Sciences.
MECHANISMS OF POST-LUMINESCENCE OF NITROGEN IRRADIATED BY ALPHA PARTICLES [MECANISMES DE LA POST-LUMINESCENCE DE L'AZOTE IRRADIE PAR DES PARTICULES ALPHA]
Pierre Millet (Ph.D. Thesis) 1970 100 p refs In FRENCH; ENGLISH summary
(NP-18425) Avail: AEC Depository Libraries

The mechanism of the luminescence of pure nitrogen at pressures between 50 and 700 torrs irradiated by alpha particles from Po-210 was studied. The main band heads found in the emission spectra of this gas occurred between wavelengths of 200 and 800 nm. The study of the law of variation, according to the pressure, of the ratio of the intensities at the band heads of the first negative system of N2(+) and the second positive system of N2 yields information about the loss of excitation energy process. Author (NSA)

N71-18333# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.

MEASUREMENT OF THE ENERGY AND SPATIAL DEPENDENCE OF NEUTRON INFLUENCE FUNCTIONS IN THE FAST CRITICAL ZERO-ENERGY ARRANGEMENT [MESSUNG DER ENERGIE- UND ORTSABHEANGIGKEIT DER NEUTRONENEINFLUSSFUNKTION IN SCHNELLEN KRITISCHEN NULL-ENERGIE-ANORDNUNGEN]

E. Korthaus (Ph.D. Thesis) May 1970 107 p refs In GERMAN; ENGLISH summary

(KFK-1141) Avail: AEC Depository Libraries

Measurements of the energy and spatial dependence of neutron importance in the SNEAK assemblies 3A-2 and 3B-2 are reported as well as the determination of the energy spectra and intensities of the neutron sources used for the measurements. The importance measurements are compared with multigroup calculations. The various measuring methods are described in detail. The mathematical properties of the importance function and some aspects of its numerical calculation are discussed. Author (NSA)

N71-18339# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

PHOTOPRODUCTION OF VECTOR MESONS

Robin Marshall Jul. 1970 31 p refs Presented at the Daresbury Study Weekend on Vector Meson Production and Omega-Rho Interference, Daresbury, Engl., 13 - 14 Jun. 1970 Prepared in cooperation with MIT, Cambridge

(DESY-70/32) Avail: AEC Depository Libraries

The photoproduction of rho baryons on protons and on complex nuclei, the real part of the rho scattering amplitude, nuclei radii, the photoproduction of omega and phi baryons, total hadronic cross sections, and other possible vector mesons are studied. NSA

N71-18340# Iowa State Univ. of Science and Technology, Ames.

DECAY OF Ru 95 AND Tc 103

Warren Walter Hein (Ph.D. Thesis) Aug. 1970 89 p refs

(Contract W-7405-eng-82)

(IS-T-391) Avail: NTIS

The decay of Ru-95 to levels in Tc-95 was investigated with Ge(Li) detectors used singly and in coincidence. An NaI(Tl) anticoincidence shield was used to suppress the Compton background in the singles spectrum, increasing sensitivity to low intensity gamma rays. Energies and intensities were determined for 36 transitions. Gamma-ray cascades are identified by Ge(Li) - Ge(Li) coincidence measurements. From these data, a decay scheme which accommodates 33 transitions was constructed. Branching ratios and log(ft) values for the decay to levels of TC-95 were calculated. Spins and parities were deduced from the beta- and gamma-ray branching ratios. The experimental levels of Tc-95 are compared with the predictions of the effective interaction calculations. Author (NSA)

N71-18341# Pittsburgh Univ., Pa. Dept. of Physics.

LOCALLY GENERATED DILATATION CHARGE IN THE THIRRING MODEL

J. H. Lowenstein and B. Schroer Oct. 1970 26 p refs

(Contract AT(30-1)-3829)

(NYO-3829-61) Avail: NTIS

By applying a normal product quantization the energy-momentum tensor of the Thirring model is constructed as a local function of the Thirring fields. It is shown that the commutation relation of the dilatation current with the field is anomalous and that the space integrals converge on a dense set of states to the group generators. The appearance of anomalous dimensions for local products of Thirring fields is discussed in the special case of a bilinear mass interaction. Author (NSA)

N71-18342# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).

CALCULATION OF THE COMPONENTS OF SCATTERED NEUTRONS AT DIFFERENT MEASURING LOCATIONS IN A LABORATORY BEING DESIGNED FOR THE NEUTRON DOSIMETRY BUILDING AT THE FEDERAL INSTITUTE FOR ENGINEERING PHYSICS [BERECHUNG DES ANTEILS VON STREUNEUTRONEN AN VERSCHIEDENEN MESSPLAETZEN IN DER GEPLANTEN EXPERIMENTIERHALLE DES BAUVORHABENS NEUTRONENDOSIMETRIE DER PHYSIKALISCH TECHNISCHEN BUNDESANSTALT]

H. Schoelermann Mar. 1970 31 p refs In GERMAN; ENGLISH summary

(PTB-1/70) Avail: AEC Depository Libraries

The influence of different experimental arrangements of targets, detectors, and shielding on the flux of scattered neutrons is calculated and discussed under simplifying assumptions. Author (NSA)

N71-18347# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

PROGRAM FOR CALCULATION OF FISSION-PRODUCT ACTIVITY: CALCULATED ACTIVITY AND EXPERIMENTAL IDENTIFICATION (PROGRAM ACTIF) [PROGRAMME DE CALCUL POUR SPECTROMETRIE DES PRODUITS DE FISSION ACTIVITE THEORIQUE ET IDENTIFICATION EXPERIMENTALE (PROGRAMME ACTIF)]

R. Le Meur and C. Poux 8 Apr. 1970 63 p In FRENCH

(CEA-N-1308) Avail: AEC Depository Libraries

The fission product activity was calculated by the program according to experimental conditions (irradiation, decrease, collection). The intensity of radiations emitted by the fission products was also determined. The program is compatible with C.D.C. and I.B.M. and is recorded on the MAJONG disc. The structure of the program and the application of the subprograms are presented. An example calculation and the listing of the program are given. Author (NSA)

N71-18350# Strasbourg Univ. (France). Faculte des Sciences.

PHOTOPRODUCTION OF A POSITIVE PION FROM HYDROGEN AT 180 DEG NEAR THE FIRST PION NUCLEON RESONANCE [PHOTOPRODUCTION DU PION POSITIF SUR L'HYDROGENE A 180 DEG AUTOUR DE LA PREMIERE RESONANCE PION-NUCLEON]

Jean-Pierre Pahin (Ph.D. Thesis) 30 Jan. 1970 112 p refs In FRENCH

(LAD-1225) Avail: AEC Depository Libraries

The photoproduction of a positive pion from hydrogen is discussed and the different methods used for evaluating the dispersion integrals are described. The detection of the backward scattered positive pion was made in the region of the first pion nucleon resonance. Experiments and the experimental apparatus are described and the method used to calculate the dimensions of the diaphragms is detailed. Methods used to obtain, from the data, the differential cross sections in a center of mass system and the various corrections made are also described. NSA

N71-18359# Paris Univ., Orsay (France). Faculte des Sciences.

STUDY OF THE ELASTIC AND INELASTIC SCATTERING OF 156 MeV PROTONS BY EVEN-EVEN ISOTOPES OF TIN [ETUDE DE LA DIFFUSION ELASTIQUE ET INELASTIQUE DES PROTONS DE 156 MeV PAR LES ISOTOPES PAIRS DE L'ETAIN]

Vincent Comparat (Ph.D. Thesis) Jun. 1970 57 p refs In FRENCH

(NP-18461) Avail: AEC Depository Libraries

The scattering of 156-MeV protons by Sn-116, Sn-118, and Sn-120 was studied. The experimental equipment and the results obtained for the scattering cross sections are presented. The elastic scattering is interpreted in terms of the optical model; two rapid methods for interpreting the inelastic scattering are then described. The nuclear wave functions arising from three different calculations using the quasi-particle formalism are used; the usefulness of the DWIA as a tool for studying nuclear models is demonstrated. NSA

N71-18360# Paris Univ., Orsay (France). Lab. de L'Accelerateur Lineaire.

MEASUREMENT OF THE RADIATIVE DECAY MODES OF THE PHI-MESON(0) (PHI-MESON(0) YIELDS ETA-MESON(0) GAMMA, PHI-MESON(0) YIELDS PION(0) GAMMA) WITH THE ORSAY STORAGE RING

D. Benaksas, G. Cosme, B. Jean-Marie, S. Jullian, F. Laplanche et al Sep. 1970 14 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, Aug. 1970

(LAL-1240; CONF-700806-42) Avail: AEC Depository Libraries

A large solid angle detector was used to observe many body final states in the decays of the neutral phi-meson. In the decay modes neutral phi-meson yields neutral eta-meson gamma and neutral phi-meson yields neutral pion gamma, 3 gamma rays were detected. The data were taken at the peak of the neutral phi-meson and the normalization is given by scattering. The values found are B yields neutral eta-meson gamma/phi-meson yields all = 0.020 + or − 0.0075, B yields neutral pion gamma/phi-meson yields all < 0.0024. Author (NSA)

N71-18361# Paris Univ., (France). Faculte des Sciences.

MOTION OF INDIVIDUAL PARTICLES IN STELLARATOR-TYPE MAGNETIC CONFIGURATIONS [MOUVEMENT DES PARTICULES INDIVIDUELLES DANS DES CONFIGURATIONS MAGNETIQUES DU TYPE STELLARATOR]

Monique Delachartre (Ph.D. Thesis) 10 Jul. 1970 59 p refs In FRENCH

(NP-18475) Avail: AEC Depository Libraries

The properties of stellarator-type magnetic configurations are described, and a description of the motion of a charged particle in the stellarator field is given. The general equation of motion is not easily integrable. In the case of an adiabatic approximation, i.e., when the magnetic field varies slowly in time and space, an equation describing a mean trajectory of a particle is obtained. This equation is also difficult to integrate. If the motion of the particle is periodic along the field lines and its drift motion slow, an equation describing the mean trajectory of the guiding center is obtained and the conservation of longitudinal invariance deduced. A study of particle motion in a straight configuration indicated the existence of two classes of particles. NSA

N71-18362# Paris Univ., Orsay (France). Faculte des Sciences.

THE ABSORPTION OF PIONS IN FLIGHT BY VERY LIGHT NUCLEI [ABSORPTION DE PIONS EN VOL PAR DES NOYAUX TRES LEGERS]

Christiane Lazard-Martinet (Ph.D. Thesis) 10 Apr. 1970 75 p refs In FRENCH

(NP-18446) Avail: AEC Depository Libraries

The reversable absorption reaction of a pion by a deuteron positive pion + deuteron yields proton + proton in the energy range of 0 to 300 MeV was studied. This reaction was described with the aid of the elementary pion nucleon interaction. The following conclusions were drawn: even for pions of practically zero energy, the direct absorption model by a single nucleon is insufficient, the two nucleons of the deuteron participate in the absorption of the pion. If the pions have energies in excess of 70 MeV, partial pion waves must be introduced. The total and differential cross sections are critically dependent upon the form of the short distance nuclear wave functions. Author (NSA)

N71-18368# Iowa State Univ. of Science and Technology, Ames.

ELECTRON ENERGY LOSS TO SURFACE EXCITATIONS IN THIN FILMS

Jay Benton Chase (Ph.D. Thesis) Nov. 1970 144 p refs

(Contract W-7405-eng-82)

(IS-T-380) Avail: NTIS

The energy lost by fast electrons passing through thin films is calculated using classical electrodynamics, including retardation and a small scattering angle approximation. An energy-loss theory is developed for 25-keV electrons incident perpendicular to a film of LiF crystal described by a local dielectric function. It is shown that a large loss peak occurs which corresponds to the low-frequency surface phonon and that the high-frequency surface phonon is not observable in very thin samples. The energy loss distribution is integrated over appropriate scattering-angle and energy-resolution functions and compared to the experiment of other authors. All the features of the experimental energy loss distribution are represented well by the theory. The effects of using a poor conductor (amorphous carbon) as a film substrate are shown to be negligible. Author (NSA)

N71-18369# Iowa State Univ. of Science and Technology, Ames.

CONSTRUCTION OF A THREE CRYSTAL SPECTROMETER AND A STUDY OF THE DECAY OF Nb-90

S. Oliver Simmons (Ph.D. Thesis) Aug. 1970 72 p refs

(Contract W-7405-eng-82)

(IS-T-389) Avail: NTIS

A gamma ray spectrometer consisting of a Ge(Li) detector partially surrounded by two NaI(Tl) scintillators was constructed. The instrument has two modes of operation, the pair spectrometer mode for analyzing high energy gamma rays (above 1.022 MeV) and the Compton suppression mode for studying weak gamma rays in the presence of intense higher energy background radiation. The decay of Nb-90 to levels in Zr-90 was investigated using the three crystal spectrometer in the Compton suppression mode to reduce background from the intense 2186 and 2319 keV transitions. Energies and absolute intensities of thirteen gamma ray transitions were determined. Using the K-conversion electron intensities from the work of other investigators and the given gamma ray intensities, conversion coefficients for the transitions were calculated. Comparisons with theoretical values enabled deduction of the multipolarities of most of the transitions. Author (NSA)

N71-18370# Brookhaven National Lab., Upton, N.Y.

ANGULAR DISTRIBUTIONS IN NEUTRON-INDUCED REACTORS. VOLUME 1: Z = 1 TO 20

Donald I. Garber, Lars G. Stroemberg, Murray D. Goldberg, Dermott E. Cullen et al Jan. 1970 452 p refs Sponsored by AEC 3d Edition

(BNL-400-Vol-1; EANDC(US)-138(U)) Avail: NTIS HC $6.00/MF $0.95

The significant experimental observations on the angular distributions of scattered neutrons and of the products of the reactions of fast neutrons with nuclei are compiled. The tabulation gives detailed results of angular distribution experiments and indicates where they are published. Data are presented in graphical or tabular form. If sufficient differential elastic scattering data are available, a three-dimensional orthographic display of fitted curves vs neutron energy is constructed. Where a body of data exists in the form of coefficients of Legendre polynomials, these are presented in tabular form and the differential cross sections synthesized from these coefficients are presented in an orthographic display. NSA

N71-18371# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SINGLE-PHONON STATES OF EVEN-EVEN NUCLEI IN THE ACTINIDE REGION
A. L. Komov, L. A. Malov, and V. G. Solovev 1970 19 p refs In RUSSIAN
(JINR-P4-5126) Avail: AEC Depository Libraries

The properties of the lowest even–even nucleus states of the actinide region are investigated systematically within the framework of the superfluid model with the multipole–multipole interaction in a single-phonon approximation. The energies and transition probabilities for E lambda-transitions are calculated, and the structure of quadrupole states is analyzed. The Saxon–Woods potential states and those of the Nilsson potential are used as a single-particle basis. Author (NSA)

N71-18372# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
RECENT RESULTS FROM THE PLEIADE MIRROR DEVICE
R. Geller, B. Jacquot, and C. Jacquot 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug. –4 Sep. 1970
(CEA-CONF-1603; CONF-700817-13) Avail: AEC Depository Libraries

Energetic electrons were trapped in a magnetic mirror and energetic ions were confined by electrostatic potentials. The energetic particles had lifetimes of several milliseconds. NSA

N71-18373# Gulf General Atomic, San Diego, Calif.
MICRODETERMINATION OF FLUORINE IN HIGH-PURITY TUNGSTEN METAL BY PHOTOACTIVATION ANALYSIS
G. Buzzelli and K. McDonald 4 Nov. 1970 9 p
(Contract AT(04-3)-167)
(GA-10125) Avail: NTIS

A nondestructive method for determination of fluoride in assemblies of high purity tungsten by photoactivation analysis was investigated. The samples were irradiated using the 45-MeV linear accelerator and counted over an 8-hr period. The precision of the method appeared to be within + or – 10%, even at the 5-ppm level. NSA

N71-18374# Lyon Univ. (France). Inst. de Physique Nucleaire.
THE ELASTIC SCATTERING OF 28 MeV NEUTRONS BY DEUTERIUM [DIFFUSION ELASTIQUE DES NEUTRONS DE 28 MeV SUR LE DEUTERIUM]
Michel Gouanere (Ph.D. Thesis) Apr. 1970 120 p refs In FRENCH
(LYCEN-7026) Avail: AEC Depository Libraries

A complex apparatus for studying n–d scattering at 28 MeV is described. The 28 MeV neutrons were produced from a 27-MeV deuteron beam by the H-2(d,n)He-3 reaction. The differential cross sections for elastic neutron–deuteron scattering were measured in a center-of-mass system for angles between 56 and 114 deg and 150 and 180 deg. The results obtained are in good agreement with those predicted by phase-shift analysis for p–d scattering at about the same energy, taking into account the Coulomb contribution. The neutron–deuteron system constitutes the simplest dynamic system which permits the study of a three-nucleon reaction without Coulomb forces. Theoretical calculations using the impulse approximation were compared with those using the Faddeev–Lovelace equations in the case of a separable potential in the s state. The results obtained using the dispersion relations are also given. NSA

N71-18381# Lyon Univ. (France). Inst. de Physique Nucleaire.
MECHANISM OF THE (alpha, 2alpha) BREAKUP REACTION IN A THREE BODY FORMULATION
G. Burdet and M. Perrin May 1970 6 p refs
(LYCEN-7036) Avail: AEC Depository Libraries

The mechanism of the (alpha, 2alpha) breakup reaction was studied in the framework of the three-body problem. The process was postulated to be based on the interaction through the two-body potentials of a bombarding alpha particle with a compound target consisting of two particles: the core and an alpha cluster. NSA

N71-18384# Japan Atomic Energy Research Inst., Tokyo.
DETERMINATION OF URANIUM CONTENT OF THE U-Al ALLOY BY DETECTING FISSION NEUTRONS
Yoshihisa Ohno, Koichi Okamoto, and Shoichi Ohtomo Aug. 1970 19 p refs In JAPANESE
(JAERI-MEMO-4106) Avail: AEC Depository Libraries

Fission neutrons, emitted from a highly U-235-enriched U–Al alloy by irradiation of slow neutrons, were detected to determine quantities of U-235 in the alloy. The uranium contents of the alloy were determined from the quantities of U-235 in a test piece relative to those in a reference sample. An apparatus with ten BF3 counters annularly arranged for scattering cross section measurement was adopted for detecting the fission neutrons after a slight modification of the shielding. The quantities of U-235 in the enriched U–Al alloy could be determined sufficiently and accurately by this method. Author (NSA)

N71-18385# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
LONG LIVED STATES IN Po 204 AND Po 206
R. Broda, S. Chojnacki, Ch. Droste, T. Morek, and W. Walus 1970 11 p refs
(JINR-E6-5197) Avail: AEC Depository Libraries

Information obtained from a study of the decay of At-204 and At-206 used to construct a level scheme for Po-204 and Po-206. In both nuclei there were found long-lived states. They are 143 nsec in Po-204 and 212 nsec in Po-206. These states are identified as the 8+ member of the band of levels resulting from the proton configuration (h sub 9/2) squared. Author (NSA)

N71-18386# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d-Etudes Nucleaires.
LENGTH VARIATIONS OF THE ALPHA, BETA, AND DELTA PHASES OF PLUTONIUM DUE TO SELF-IRRADIATION AT 1.4 K AND 4.2 K [VARIATIONS DE LONGUEUR DUES A L'AUTOIRRADIATION A 1.4 K ET 4.2 K DES PHASES ALPHA, BETA, ET DELTA DU PLUTONIUM]
Jean Jacquemin and Robert Lallement 1970 11 p refs In FRENCH Presented at 4th Intern. Conf. on Plutonium and Other Actinides, Santa Fe, N.Mex., 5–9 Oct. 1970
(CEA-CONF-1619; CONF-701001-8) Avail: AEC Depository Libraries

The variations in length and crystal parameters of alpha plutonium which do not lead to the same volume variation values were studied with the laws governing length variation with irradiation time. Results of two series of experiments explaining these phenomena are presented. Very pure plutonium was used for the first experiment (200 to 300 ppM impurities) and less pure plutonium for the second (800 ppM impurities), the length variations being measured by means of stress gages. The first experiment showed up the mobility of certain defects (interstitials) in the alpha plutonium lattice at temperatures below 4.2 K. The length variations observed at 1.2 K are large. The second experiment showed a contraction of the alpha and beta phases under the effect of self irradiation at 4.2 K. This irradiation induced densification is associated with the intrinsic properties of point defects in the crystal lattice of the beta, delta, and probably epsilon phases of plutonium. Author (NSA)

N71-18416# Northeastern Univ., Boston, Mass. Dept. of Physics.
DENSITY CORRELATIONS IN A MANY PARTICLE SYSTEM
F. Y. Wu Jan. 1971 4 p refs
(Grants NSF GP-9041; NSF GP-25306)
(NUB-2051) Avail: Issuing Activity

The multiple density correlation function of a many particle system is evaluated using the convolution approximation for the n-particle distribution function. Author

N71-18417*# Rensselaer Polytechnic Inst., Troy, N.Y.
INVESTIGATION OF THE STRUCTURE OF RADIATION DAMAGE IN LITHIUM-DIFFUSED SILICON Final Report, 1 Jan. – 5 Oct. 1970
John C. Corelli 5 Oct. 1970 47 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952456)
(NASA-CR-116790) Avail: NITS CSCL 18H

Infrared photoconductivity (1 to 10 microns) and infrared spectroscopy (1 to 50 microns) were used as the probes. The defects were induced in the material by 1.5 MeV electrons with the sample temperature at 300 K during irradiation; one irradiation experiment was run at about 100 K. No infrared active defect bands were induced by electrons of E less than 5 MeV up to radiation fluences of 3.3 × 10 to the 17th power e/sq cm. Dominant radiation-induced photoconductivity arises from levels at 0.2, 0.39, 0.54, 0.6, 0.7, and 0.8 eV in oxygen-rich Si and at 0.2, 0.54, 0.8, 0.92, and 1.0 eV in oxygen-lean Si. The levels are found to disappear and in some cases shift with annealing in the 100 to 450 C temperature range. In all cases the spectrum is dominated by 3 or 4 energy levels after irradiation and after various anneals. Energy levels obtained by other researchers using carrier concentration, minority carrier lifetime, and photoluminescence as the probes are compared to the measurements. Author

N71-18418# Northeastern Univ., Boston, Mass. Dept. of Physics.
SPIN ZERO POLE DOMINANCE IN THE WEAK AND ELECTROMAGNETIC INTERACTIONS OF THE K MESON
R. Arnowitt, M. H. Friedman, P. Nath, and P. Pond (Westfield Coll., London, Engl.) Jan. 1971 12 p refs Sponsored by NSF
(NUB-2048) Avail: Issuing Activity

The assumption of pion, eta-meson, and sigma-meson dominance of the weak and electromagnetic decays of the K meson is examined using the hard meson current algebra amplitudes for the strong interaction factors. The K yields 3 pion decay spectrum, the neutral K sub L yields 2 photon and the neutral K (K sub L) -(K sub S) mass difference are calculated and compared with experiment. Author

N71-18504# Syracuse Univ., N.Y. Dept. of Physics.
IMPLICATIONS OF LOCAL DUALITY IN A SET OF COUPLED REACTIONS
M. J. King and C. Kameshwar [1970] 30 p refs Sponsored by AEC
(SU-1206-235; NYO-3399-235) Avail: NTIS

Some consequences of local duality are examined and compared to experiment in limited energy regions. The assumption that the imaginary parts of the direct channel helicity amplitudes vanish in the forward (backward) scattering if the crossed t-channel (u-channel) is exotic leads to systems of equations relating resonance contributions in the direct channel. The solutions predict certain patterns of particles degenerate in mass but with different SU(3), spin, and parity assignments. In particular, the inclusion of spin considerations yields the result that the particles on leading trajectories must be accompanied by daughters with prescribed ratios of coupling constants between the parent and daughter states. The link between these results and those which follow from a complementary description in terms of Regge residues is discussed. Author (NSA)

N71-18514# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
METHOD FOR NEUTRON RESONANCE SPIN ASSIGNMENT BY DIFFERENTIAL SCATTERING ANALYSIS
George J. Kirouac and Juergen Nebe Sep. 1969 29 p refs
(KFK-1069) Avail: AEC Depository Libraries

An exploratory investigation of the use of few-angle neutron scattering measurements to assign resonance spins and parities is presented. The cross section shape as a function of the scattering angle is illustrated for s-, p-, and d-wave neutrons. Textbook examples are calculated for isolated resonances and for interfering resonances. A specific example is given for Ca-40; and a scattering experiment, which is in preparation, is outlined. It is concluded that study of the resonance shape observed at a few scattering angles can be used profitably to assign spins and parities even for closely spaced interfering resonances. Author (NSA)

N71-18516# Paris Univ., Orsay (France.) Faculte des Sciences.
EVEN-EVEN ISOTOPES OF TELLURIUM
Jean-Marie Lagrange (Ph.D. Thesis) 1970 102 p refs In FRENCH
(NP-18447) Avail: AEC Depository Libraries

Even – even isotopes of tellurium of masses between 122 and 130 were studied by Coulomb excitation. The results obtained yielded various quantitative information about quadrople and octupole excitation within the nuclei. The application of classical nuclear spectroscopy to the study of the radioactivity of the corresponding isobars of iodine and antimony led to the completion of the nuclear level schemes of Te-124 and Te-122 and to the proposal of nuclear level schemes for Te-120 and Te-118. The principal characteristics of the theoretical treatment of the nondeformed even-even nuclei were then elucidated. The microscopic calculations describing the collective quadrupole and octupole excitations, and the semimicroscopic (intermediate coupling core-particle) calculations which were capable of giving good agreement up to about 2 MeV, where analyzed individually. Author (NSA)

N71-18517# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
HIGH RESOLUTION MEASUREMENTS OF RADIATION NEUTRON CAPTURE IN Ti 47, Fe 56, Ni 58, Ni 60, AND Ni 61 BETWEEN 7 AND 200 keV
A. Ernst (Vienna Univ.), F. H. Froehner, and D. Kompe Jun. 1970 21 p refs Presented at the 2d Intern. Conf. on Nucl. Data for Reactors, Helsinki, 15 – 19 Jun. 1970 Sponsored by US-EURATOM Fast Reactor Exchange Program
(KFK-1231; IAEA-CN-26/11; EURFNR-809; Conf-700605-7)
Avail: AEC Depository Libraries

Neutron capture in enriched samples of Ti-47, Fe-56, Ni-58, Ni-60, and Ni-61, has been measured in the energy range 7 to 200 keV with the time-of-flight method. The time resolution was better than 2 ns/m. Neutrons were produced by a pulsed 3-MV Van de Graaff accelerator via the (Li-7)(p,n) reaction. Capture events were detected with an 800-liter liquid scintillator tank. The (Au-197)(neutron,gamma) cross section served as standard. Incorporation of transmission results, especially of resonance spins and total widths, in the analysis and careful treatment of multiple scattering permitted the determination of radiation widths for a large number of s-wave resonances. Author (NSA)

N71-18518# Paris Univ., Orsay (France). Inst. de Physique Nucleaire.
FISSION CHARACTERISTICS OF TRANSURANIUM ELEMENTS [CARACTERISTIQUES DE LA FISSION DES ELEMENTS TRANSURANIENS]
Marc Lefort Apr. 1970 19 p refs In FRENCH

(NP-18407) Avail: AEC Depository Libraries

Attempts were made to predict the fission characteristics of transuranium elements. The evolution of the configurations of the liquid-drop model as a function of fission parameters was reviewed, and the superposition of a microscopic model on the liquid-drop model was considered; in particular, the Nilsson microscopic model was applied to the study of nuclear deformations. Considerable theoretical progress was made on this problem; new phenomena concerning fission isomers could be predicted and related to resonances found below the threshold of neutron-induced fissions. However, the mechanisms involved remain obscure and most of the predictions are tentative. Author (NSA)

N71-18547# Kansas State Univ., Manhattan.
VIBRATIONAL STATES OF ELECTRONICALLY EXCITED MOLECULES Final Progress Report, 1 Jun. 1969–30 Sep. 1970
C. E. Hathaway and John D. Spangler 30 Sep. 1970 3 p
(Grant DA-ARO(D)-31-124-G1118)
(AD-715740; AROD-8170.1-C; FPR-3) Avail: NTIS CSCL 7/4

The report briefly summarizes research concerned with the following: Raman spectra of oriented triphenyl methane; Experiments conducted using optical pumping to produce the radical (Ph)3C; Oxygen pumped with a microwave system to produce a steady flow of O2 molecules in the excited state singlet Delta(g); and Experiments performed in which benzene in a cyclohexane matrix was optically pumped with a xenon lamp. Author (GRA)

N71-18548# California Univ., Berkeley. Lawrence Radiation Lab.
POLARIZATION AND CROSS SECTION MEASUREMENTS IN p He-4 SCATTERING FROM 20 TO 40 MeV
A. D. Bacher, G. R. Plattner, H. E. Conzett, D. J. Clark, H. Grunder et al Jul. 1970 2 p refs Presented at the 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 31 Aug.–4 Sep. 1970
(Contract W-7405-eng-48)
(UCRL-19943; CONF-700811-1) Avail: NTIS

An axially injected polarized proton beam was used to measure p–(He-4) elastic scattering between 20 and 40 MeV. The beam polarization was approximately 0.75. Angular distributions of cross sections and polarizations were measured at 2 MeV intervals at 20 laboratory angles between 17.5 and 150 deg. Results are shown for 24 and 26 MeV, as well as a contour plot of the complete polarization data. The effect of the 16.65-MeV 3/2(+) state of Li-5 is clearly seen near 23 MeV. NSA

N71-18549# Purdue Univ., Lafayette, Ind. Dept. of Physics.
THE PION (+) PROTON YIELDS f (0) DELTA HYPERON (++) AT 13.1 GeV/c
J. A. Gaidos, C. R. Ezell, J. W. Lamso, and R. B. Willmann [1970] 12 p refs
(Contract AT(11-1)-1428)
(COO-1428-238) Avail: NTIS

Data for the reaction positive pion proton yields f(o) Delta hyperson (++) at 13.1 GeV/c are presented and discussed within a Reggeized pion exchange model with absorption. Author (NSA)

N71-18569# California Univ., Berkeley. Lawrence Radiation Lab.
PHOTOPRODUCTION OF PIONS(+) FROM A POLARIZED PROTON TARGET AT 5 AND 16 GeV
Charles Conover Morehouse (Ph.D. Thesis) Aug. 1970 107 p refs
Contract W-7405-eng-48)
(UCRL-19897) Avail: NTIS

The measurement of the asymmetry in the cross section for the reaction gamma proton yields positive pion neutron between the two states of polarization of the initial proton normal to the plane of scattering is described. The laboratory photon energies, k, were 5 GeV and 16 GeV. A butanol polarized targed was used with the SLAC 20 GeV/c magnetic spectrometer. The data show a suizeable asymmetry at both 5 GeV and 16 GeV. Author (NSA)

N71-18574# California Univ., Berkeley. Lawrence Radiation Lab.
SEARCH FOR POLARIZATION IN ELASTIC ELECTRONIC-PROTON SCATTERING AT 15 AND 18 GeV
Thomas Mabrey Powell (Ph.D. Thesis) Aug. 1970 102 p refs
(Contract W-7405-eng-48)
(UCRL-20093) Avail: NTIS

The assymmetry in the elastic scattering of electrons from a polarized proton target was measured. An interference between the imaginary part of the two-photon-exchange and the one-photon-exchange amplitude could produce a polarization effect. The results indicate no asymmetry within the experimental accuracy of 1 to 2% at four-momentum transfer squared values of 0.38, 0.59, and 0.98 (GeV/V/c) squared. Author (NSA)

N71-18575# Sheffield Univ. (England). Dept. of Physics.
PHOTOIONISATION PHENOMENA AND PHOTOELECTRON SPECTROSCOPY
J. S. Rousseau Oct. 1970 47 p refs Conf. held at Oxford, 14–16 Sep. 1970
(Contract DAJA37-69-C-1223)
(AD-715408; ARDG(E)-E-1258) Avail: NTIS CSCL 7/4

The document is largely comprised of abstracts of papers presented at the conference. The application of photoelectron spectroscopy dealt with were particularly those of species identification and qualitative analysis through the characteristic shapes and shifts of the spectral lines of atoms in different chemical environments. The technique of photoelectron spectroscopy with its high sensitivity and wide energy ranges, provides a very useful means of examining some of the fundamental ideas in molecular orbital theory. Koopmans theorem is found to be fairly well obeyed in most cases; orbital assignments of the experimental spectra fit in well with ideas of bonding and antibonding orbitals, and charge shifts can be well correlated with electro-negativities and bond polarity calculations. Selection rules can be checked experimentally, and models of the vibronic structure of complex molecules can be put to a searching test. GRA

N71-18623# Northeastern Univ., Boston, Mass. Dept. of Physics.
HARD MESON CURRENT ALGEBRA AND THE BREAKDOWN OF PCAC
M. G. Miller (Ph.D. Thesis) Nov. 1970 31 p refs
(NUB-2023) Avail: NTIS

The Arnowitt, Friedman and Nath model of PCAC breakdown which permits the two body photon decays of neutral pions, eta-mesons, and vector mesons is extended to higher order. The model is required to satisfy a set of conditons, the most important of which is that it be consistent with U(3) × U(3) hard meson current algebra. It is shown that if PCAC is no longer pole dominated, the given general sigma commutator cannot be pole dominated. In addition, the variation of the Lagrangian under chiral transformations will no longer be proportional to the divergences of the currents. The model is used to calculate decay widths for the given eta-meson, omega baryon, and phi baryon processes. Author

N71-18624# Northeastern Univ., Boston, Mass.
PHENOMENOLOGICAL MOLECULAR FIELD THEORY OF THE MOTT-WIGNER TRANSITION IN MAGNETITE

J. B. Sokoloff Jan. 1971 32 p refs
(NUB-2020) Avail: NTIS

The measurement of the variation of the transition temperature of magnetite with stoichiometry is discussed in terms of the molecular field solution of a lattice gas model of the Mott-Wigner insulator to metal transition. The observed first order transition is reproduced by substituting a phenomenologically screened interaction, in which the dielectric constant causing the screening decreases with increasing order parameter. Since the phenomenological screening necessary to produce the observed results is very large compared to that expected on the basis of electronic screening, it is postulated that the dielectric constant includes the effect of local charge polarization accompanying the ordering. Inelastic neutron scattering and optical absorption are discussed as means of observing the elementary excitations of the system and to deduce some of the parameters in the theory. The low-lying excitations in the ordered state are shown to be excitons with flat dispersion, and their energies and cross sections are calculated. Author

N71-18658*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF INTERMITTENT ENHANCEMENT OF ION EMISSION FROM A TUNGSTEN SURFACE USING THE FIELD ION MICROSCOPE
Victor G. Weizer Washington Mar. 1971 14 p refs
(NASA-TN-D-6214; E-5511) Avail: NTIS CSCL 20H

An intermittent enhancement of ion emission or blinking effect is described which is observed when a few parts-per-million neon are added to the imaging gas in a helium-tungsten field-ion microscope. Measurement of the variation of the blinking rate of a single emitting tungsten atom with applied voltage, tip temperature, and gas pressure suggest that: (1) adsorption of neon on the apex of a protruding tungsten substrate atom is responsible for the blinking, and (2) the rate of blinking is proportional to 1 − P(++) sub I, where P(++) sub I is the probability of double ionization as a neon atom passes through the ionization zone above a protruding tungsten emitter. Author

N71-18659# California Univ., Berkeley. Lawrence Radiation Lab.
SEARCH FOR T-VIOLATION IN THE INELASTIC SCATTERING OF ELECTRONS FROM A POLARIZED PROTON TARGET
Stephen Rock (Ph.D. Thesis) Aug. 1970 140 p refs
(Contract W-7405-eng-48)
(UCRL-20041) Avail: NTIS

The recent discovery of a violation of CP invariance has led to speculation on the origins and nature of the symmetry violating forces. This violation in the electromagnetic interactions of hadrons is investigated. A violation of time-reversal invariance in inelastic electron scattering from a polarized proton target was sought. A difference in cross sections (asymmetry) when the target was polarized in opposite directions along the normal to the scattering plane would mean either a time-reversal-invariance violation or a contribution from high order effects. Data were taken using electron and positron beams to distinguish between the two possible causes of an asymmetry. Scattered electrons were detected in a magnetic spectrometer and the mass of the inferred outgoing hadronic state was calculated. No sizable violation of time-reversal invariance was found. Author (NSA)

N71-18666# Oregon Univ., Eugene.
ENERGY AND ANGULAR RESOLUTION IN PION-PION SCATTERING AND OTHER COLLIDING BEAM EXPERIMENTS
Paul L. Csonka [1970] 15 p refs Sponsored by AEC
(RLO-2041-51) Avail: NTIS

In certain types of colliding beam experiments, the interaction region may contain particles within a wide momentum range. It is described how the energy and angle dependance of the cross section can be measured under these circumstances. Pion−pion scattering in a minining is given as an example. Author (NSA)

N71-18667# Toulouse Univ. (France).
USE OF CELLULOSE NITRATE FOR ALPHA-PARTICLE DETECTION [UTILISATION DU NITRATE DE CELLULOSE POUR LA DETECTION DES PARTICULES ALPHA]
Jacques Anno (Ph.D. Thesis) 1970 148 p refs In FRENCH; ENGLISH summary
(NP-18411) Avail: AEC Depository Libraries

A summary dealing with ionizing-particle detection in plastics and with the different mechanisms proposed to explain the track formation in those detectors is given. The most salient features of the most sensitive detecting material (cellulose nitrate) are given. After describing the apparatus and technical methods, the results of counting experiments of alpha particle tracks recorded by the detector are discussed. An easy statistical method is proposed and applied to calculate the activity of radon by counting the tracks due to alpha particles emitted by RaC. Author (NSA)

N71-18668# Chicago Univ., Ill. Dept. of Physics.
IS THE POMERANCHUK DECOUPLED FROM THE ORDINARY REGGE TRAJECTORIES?
George W. Barry Oct. 1970 10 p refs
(Contract AT(11-1)-264)
(COO-264-562; EFI-70-63) Avail: NTIS

If the amplitude for diffraction scattering is independent of the universal slope of the ordinary Regge trajectories, there results a helicity selection rule, which corresponds to s-channel helicity conservation for the diffractive part of pion proton to pion proton and photon proton to neutral rho proton reactions, in accordance with experiment. A crucial test of the selection rule is that electroproduced neutral rho mesons should be transversely polarized at high energy. Author (NSA)

N71-18669# Toulouse Univ. (France).
EVOLUTION OF THE CARRIER LIFE-TIME IN JUNCTION DIODES IRRADIATED BY HIGH-ENERGY PROTONS [EVOLUTION DE LA DUREE DE VIE DES PORTEURS DANS LES DIODES A JONCTION IRRADIEES PAR DES PROTONS DE GRANDE ENERGIE]
Jean Bielle (Ph.D. Thesis) 1970 186 p refs In FRENCH
(NP-18472) Avail: AEC Depository Libraries

The effects of 5.5 to 3,000-MeV proton and 4.5-MeV electron irradiations on carrier lifetimes were studied with different types of junction diodes and solar cells. The carrier lifetime evolution was analyzed as a function of the technological characteristics of the devices, the silicon porperties, the carrier injection rate, and the nature of the radio induced defects. An equivalence concept relative to lifetime degradation allows characterization of the effects of different nuclear particles from the structure of the defects. Author (NSA)

N71-18685# Illinois Univ., Urbana.
SPIN PARITY STUDIES OF THE ETA-MESON PION DECAY OF THE A2 MESON AND INVESTIGATION OF THE A2 PRODUCTION MECHANISM IN THE REACTION PION (−) PROTON GOES TO A2 (−) PROTON
Jeffrey Linn Lacey (Ph.D. Thesis) Feb. 1971 109 p refs
(Contract AT(11-1)-1195)
(COO-1195-200) Avail: NTIS

The results of a spin parity analysis of the eta-meson pion (−) decay mode of the A2(−) meson produced in the reaction pion (−) proton yields A2(−) proton are presented. Data for the analysis are drawn from bubble chamber experiments between 3.9 and 16

GeV/c. The analysis favors J parity = 2(+) for both upper and lower regions of the A2. Possible evidence for a weakly produced J parity = 1(−) daughter state is also presented. The evidence comes largely from an interference effect observed in the lower A2 region. Using the A2(−) yields eta-meson pion(−) data along with data on the decay channel A2(−) yields rho-meson(0) pion(−) at 5.0, 7.5, and 11.2 GeV/c, the production mechanism of the A2(−) in the reaction pion(−) proton yields A2(−) proton is investigated. Assuming that this reaction is dominated by a t channel exchange mechanism, the isospin and J parity of the exchange are investigated. The s and t cross section dependence of the data are compared with a simple Regge model. Author (NSA)

N71-18686# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
SENSITIVITY OF THE ACTIVATION ANALYSIS ON SHORT-LIVED ISOTOPES
G. V. Leushkina et al Apr. 1969 3 p refs Transl. into ENGLISH from At. Energ. (Moscow), v. 26, Apr. 1969 p 381−383
(CSIRO-Trans-10089) Avail: AEC Depository Libraries

In determining sensitivities the short-lived activities of most frequently encountered elements were counted 0.5 seconds after irradiation of a flux of 3.8 × 10 to the 11th power neutrons/sq cm-sec on a 100-channel scintillation counter. The absolute activities of the isotopes were determined from the measured areas of the photopeaks. Calculated and experimental values of the sensitivity and of the cadmium ration are given for the short-loved isotopes. NSA

N71-18687# Indiana Univ., Bloomington. Dept. of Chemistry.
ELUCIDATION OF THE B 11 NMR SPECTRA OF SOME B9H13 (LIGAND) DERIVATIVES
L. J. Todd, F. R. Scholer, G. M. Bodner, L. E. Senor, and J. C. Carter Dec. 1970 23 p refs Submitted for publication
(Contract N0014-67-A-0289-0003)
(AD-715649; TR-4) Avail: NTIS CSCL 7/2

The B11 NMR spectra at 70.6 MHz of specifically labeled B9H13 (ligand) derivatives with both neutral and negatively charged ligands have allowed an assignment of the boron resonances in this type of molecule. The assignments are quite similar to those found for B10H12 (ligand)2 derivatives.
Author (GRA)

N71-18703# California Univ., Berkeley. Dept. of Physics.
DYNAMIC NUCLEAR POLARIZATION AND SOLID STATE PHYSICS Progress Report, 15 Jul. 1969 − 1 Aug. 1970
C. D. Jeffries 1 Aug. 1970 122 p refs
(Contract AT(04-3)-36)
(UCB-34-P-20-PR-16) Avail: NTIS

Four papers, previously published and/or to be presented at conferences, are included. Their titles are: Polarization of Nuclei in solids by Optical Pumping; Polarized Solid targets; Paramagnetic Resonance and Spin lattice Relaxation in Ytterbium, Yttrium Ethyl Sulfate; and Measurement of Pair Interactions in Neodymium Ethyl Sulfate. Work in progress is discussed briefly. NSA

N71-18736# Rensselaer Polytechnic Inst., Troy, N.Y.
TEMPERATURE-DEPENDENT AND MULTI-LEVEL EFFECTS ON NEUTRON RESONANCE CROSS SECTIONS
Thomas E. Shea (Ph.D. Thesis) Sep. 1970 252 p refs Sponsored by AEC
(TID-25566) Avail: NTIS

The effects of temperature dependence and multilevel interference on neutron resonance cross sections and their manifestations on cross section-dependent quantities are examined through the application of the Quasi-Resonance Multilevel cross section formalism. Cross section expressions in this formalism are derived from the level matrix form of the R-Matrix formalism, and are given in terms of Lorentzian shape functions. The effects of nuclear thermal motion on the cross-section expressions are given in terms of the standard Doppler-broadening functions. The Quasi-Resonance Triplet Approximation is introduced to facilitate the application of the formalism to the fissile nuclides. The Triplet-Approximation fission parameters are studied in detail. For U-235, they are determined to be negligibly intercorrelated and, in all cases studied, well represented by the chi-square frequency functions. The average symmetric fission parameter and its corresponding chi-square number of degrees of freedom are seen to be energy-dependent. Author (NSA)

N71-18763# Westinghouse Research Labs., Pittsburgh, Pa. Arc and Plasma Research.
ATOMIC COLLISION PROCESSES RELATING TO THE IONOSPHERE Final Report, 1 Sep. 1969 − 31 Aug. 1970
P. J. Chantry and A. V. Phelps 1970 45 p refs
(Contract DAHC04-69-C-0094)
(AD-715715; AROD-8829-1-P) Avail: NTIS CSCL 7/4

Measurements of the attachment cross-sections in O3 reveal no dependence on temperature below 360K in the energy range 0-4 eV. The peak value of the total attachment cross-section Q(a), of about 3.0 x 10 to the -17th sq cm occurs at an electron energy of 1.07 eV. The individual cross-sections for production of O(-) and O2(-) peak at energies of 1.25 eV and 0.95 eV respectively. The ratios of the three cross-sections Q(a):Q(O(-)): Q(O2(-)) at their peaks are 1.6:1:0.75. From the measured onset for O2(-) production a value of A(O2) > or = 0.60 eV is deduced for the electron affinity of O2. Author (GRA)

N71-18764# Wisconsin Univ., Madison. Dept. of Physics.
CONFERENCE ON EXPECTATIONS FOR PARTICLE REACTIONS AT THE NEW ACCELERATORS
1 Apr. 1970 603 p refs Conf. held at Madison, Wis., 30 Mar.−1 Apr. 1970 Sponsored by AEC
(CONF-700314) Avail: NTIS

Papers summarizing very high energy interaction research are presented. Weak and electromagnetic interactions, many particle reactions, two body and quasi-two-body reactions, and field theory are discussed, and planned programs are outlined. N.E.N.

N71-18774# Toulouse Univ. (France).
NEUTRAL ULTRAFINE PARTICLES [EVOLUTION DES PARTICULES NEUTRES ULTRA-FINES]
Jean-Claude Couturaud (Ph.D. Thesis) 1970 84 p refs In FRENCH; ENGLISH summary
(NP-18413) Avail: AEC Depository Libraries

Theoretical data on the diffusion coefficient of neutral particles in a gas are given. A method for the analysis of a polydispersed aerosol by means of a diffusion battery is described. It is applied to the evolution study of the diffusion coefficient for neutral ultrafine particles with a metallic nucleus due to recombination of radioactive ions Pb-211(+) with negative ions from air. Very stable neutral particles with a diffusion coefficient were observed. The experiments were made in a filtered and cycled atmospheric air. The influence of the water vapor was investigated. The part played by the ultraviolet radiation in the coagulation phenomena was determined. These results were compared for increases of the neutral diffusion coefficient in atmospheric air. Author (NSA)

N71-18775# Oregon Univ., Eugene.
THREE PARADOXES RELATED TO FULL CAUSALITY
P. L. Csonka 17 Feb. 1970 21 p refs Sponsored by AEC
(RLO-2041-49) Avail: NTIS

In a fully causal theory, certain problems can apparently

have self contradictory solutions. This fact does not mean that full causality must be wrong. Three basic types of apparent contradictions are discussed, and it is shown that they can be resolved. Author (NSA)

N71-18776# Oak Ridge National Lab., Tenn.
SAMBO, A COLLISION ANALYSIS PACKAGE FOR MONTE CARLO CODES
V. R. Cain 1 Sep. 1970 68 p refs Sponsored by AEC and DASA
(ORNL-TM-3203) Avail: NTIS

SAMBO is a package of computer routines which handles most of the drudgery associated with analysis of collisions in a Monte Carlo code. It was written for use with the MORSE multigroup Monte Carlo code but should be readily adaptable to incorporation into other random-walk-generating codes. An arbitrary number of detectors, energy-dependent response functions, energy bins, time bins, and angle bins are allowed, with virtually no numerical limitations other than the available core storage. Analysis is divided into: uncollided and total response (fluence integrated over each response function at each detector); fluence versus energy and detector; time-dependent response (time-dependent fluence integrated over each response at each detector); fluence versus time, energy, and detector; and fluence versus angle, energy, and detector. Each quantity in the above arrays is output along with an associated fractional standard deviation. Author (NSA)

N71-18777# California Univ., Berkeley. Lawrence Radiation Lab.
HEAVY-ION IN-BEAM SPECTROSCOPY
R. M. Diamond Aug. 1970 48 p refs Presented at the Conf. on the Properties of Nuclei Far from the Region of Beta Stability, Leysin, Switzerland
(Contract W-7405-eng-48)
(UCRL-19961; CONF-700815-4) Avail: NTIS

The advantages of using heavy ion beams for in-beam gamma ray and conversion electron spectroscopy are pointed out. A number of examples of heavy ion in-beam studies are given. These include measurements of B(E2)'s, g factors, and energy-level transitions. NSA

N71-18778# California Univ., Berkeley. Lawrence Radiation Lab.
EXCITED STATE IN EVEN-EVEN FISSION PRODUCTS
E. Cheifetz, R. C. Jared, S. G. Thompson, and J. B. Wilhelmy Aug. 1970 22 p refs Presented at Conf. on the Properties of Nuclei Far from the Region of Beta Stability, Leysin, Switzerland
(Contract W-7405-eng-48)
(UCRL-19949; CONF-700815-2) Avail: NTIS

Experimental results are presented on the ground state bands of 31 even-even nuclei produced in the primary fission of Cf-252. Systematics of the energies and life-times of the transitions are given. From these data there is evidence indicating that a region of deformation in the A approximates 100 region may exist. Author (NSA)

N71-18781# San Francisco Univ., Calif. Dept. of Physics.
NEUTRON AND GAMMA-RAY MEASUREMENTS WITH NUCLEAR TRACK DETECTORS Final Report
A. L. Frank and Eugene V. Benton 30 Nov. 1970 57 p refs
(Contract DASA01-70-C-0016)
(AD-715797; DASA-2573) Avail: NTIS CSCL 18/4

The document discusses the replacement of activation analyses and photographic plates as the means of passive dosimetry. Whereas activated foils have a short half-life, speed of analysis is imperative and presents a problem. Furthermore, the analysis is complex and the energy dependence of the few foils available is such that abstracting spectral information is very difficult. One of the more significant new developments in the field of neutron detection has been made possible by the discovery of a new class of charged particle detectors called nuclear track detectors. The detecting principle is based on the delineation of individual paths of heavily ionizing charged particles such as fission fragments, recoil nuclei, alpha particles, and low velocity protons. Delineation is accomplished through a selective chemical attack of the narrow, radiation damaged region along the particles trajectory. The resulting narrow channels, referred to as tracks, can be enlarged to a convenient size for direct viewing with an optical microscope. Unlike photographic emulsions, track etch materials are insensitive to beta and gamma radiation and also to light. They can, therefore, be in the high gamma fields of testing environments. Author (GRA)

N71-18785# Joint Publications Research Service, Washington, D.C.
METHOD OF CALCULATING GROUP CROSS SECTIONS IN THE AREA OF UNRESOLVED RESONANCES [METODIKA RASCHETA GRUPPOVYKH SECHENIY V OBLASTI NERAZRESHENNYKH REZONANSOV]
M. N. Nikolayev et al *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 25-45 refs (See N71-18783 08-22)
Avail: NTIS

A method is presented for calculating group-average cross sections of resonance self-shielding in the area of unresolved resonances. The parameters of a quasi-random sequence of resonances are produced, considering fluctuations in neutron widths and separations between levels. Author

N71-18790# Joint Publications Research Service, Washington, D.C.
REEVALUATION OF THE FISSION CROSS SECTION OF URANIUM 235 AND CAPTURE CROSS SECTION OF URANIUM 238 ON THE BASIS OF AN ANALYSIS OF THE CRITICAL PARAMETERS OF THE ZPR-3 CRITICAL MASS FACILITY [PEREOTSENKA SECHENIY DELENIYA URANA 235 I ZAKHVATA URANA 238 NA OSNOVE ANALIZA KRITICHESKIKH PARAMETOV KRITSBOROK ZPR-3]
L. V. Antonova et al *In its* Studies in Phys. and Power Eng. 29 Jan. 1971 p 109-124 refs (See N71-18783 08-22)
Avail: NTIS

The changes in the 26th group fission cross sections of uranium 235 and cpature cross sections of uranium 238, resulting both from the appearance of new data and from analysis of all available microdata for these cross sections are discussed. The results of calculating the critical mass of the ZPR-3, assemblies using the BNAB system of constants are presented. Author

N71-18795# Carnegie-Mellon Univ., Pittsburgh, Pa.
MOSSBAUER EFFECT APPLICATION Final Summary Report
14 Aug. 1970 9 p refs
(Contracts Nonr-760(20); N00014-67-A-0314-0005)
(AD-715684) Avail: NTIS CSCL 7/4

The report summarizes research concerned with the Mossbauer effect. The report contains a list of the 66 publications resulting from the research. GRA

N71-18803# Illinois Univ., Urbana. Dept. of Physics.
HIGH ENERGY ELASTIC AND INEALSTIC SCATTERINGS IN phi CUBED THEORY
Shau-Jin Chang and Tung-Mow Yan (Cornell Univ., Ithaca, N.Y.) Jan. 1971 68 p refs
(Grant NSF GP-19433)
(ILL-(TH)-71-4) Avail: Issuing Activity

High energy elastic and inelastic hadron processes in a phi-cubed theory are studied. For the elastic scattering amplitude,

the leading terms are summed in each order of perturbation of the t-channel straight ladders plus those obtained by interchange of the Mandelstam variables s and u. The s-channel iteration is performed with the t-channel ladders as single units. Only the physical regions in which the incident particles retain their large momenta are considered. This procedure leads to the eikonalization of the t-channel ladders. For the inelastic production amplitude, the dominant contribution comes from diagrams with any number of totally open ladders (i.e. multiperipheral chains) modified by unopen ones. The main results are: (1) The total cross section goes to zero, a constant, or as (lns) squared for the coupling constant being smaller than, equal to, or larger than a critical value. (2) Elastic and inelastic differential cross sections are computed. (3) Nonforward s-channel unitarity is explicitly verified. (4) One particle and multiparticle spectra, average multiplicity, and number distribtuion are presented. The implications of these results to hadron physics are discussed. Author

N71-18805# Naval Postgraduate School, Monterey, Calif.
NEUTRON TRANSPORT FROM A POINT SOURCE IN A SLAB: A COMPARISON BETWEEN DIFFUSION THEORY AND TRANSPORT THEORY
John Henry Shimerda (M.S. Thesis) Sep. 1970 52 p refs
(AD-715563) Avail: NTIS CSCL 18/11

The one-speed, steady state, diffusion equation was solved for a point source and for a normal pencil beam in a homogeneous, isotropically scattering slab. Numerical results obtained using diffusion theory were compared to available transport theory results for two slab thickness. This comparison demonstrated that the diffusion theory approximation to the transport equation will yield accurate results except within about one-half mean free path of a boundary and except within about three mean free paths of a source. The best agreement between diffusion theory and transport theory is obtained if the first radial buckling constant in the diffusion solution is chosen equal to the radial buckling computed using transport theory. Author (GRA)

N71-18806# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
TABLES OF TWO PARTICLES FRACTIONAL PARENTAGE COEFFICIENTS FOR THE pN, dN, AND fN CONFIGURATIONS Technical Report, 1 Nov. 1968 - 31 May 1970
Vincent L. Donlan Oct. 1970 309 p refs
(AD-715924; AFML-TR-70-249) Avail: NTIS CSCL 7/4

The two particle fractional parentage coefficients of the configratuions p3, d3, d4, d5, f3, f4, f5, f6, and f7 are tabulated. The coefficients are given in powers of primes. The tables were prepared by photographing computer output generated from a magnetic tape containing the coefficients. The correctness of the coefficients on the tape had previously been checked by using them to calculate the electrostatic matrices. Author (GRA)

N71-18807# Wisconsin Univ., Madison. Dept. of Physics.
MOLECULAR SYSTEMS Final Report, 1 Sep. 1968 - 31 Aug. 1970
Chun C. Lin Nov. 1970 8 p refs
(Contract N00014-67-A-0128-0007)
(AD-715798) Avail: NTIS CSCL 20/12

The results of a program of research on the energy levels, electronic structure, and properties of atomic and molecular systems in various kinds of microscopic environment are summarized. Specific topics include (1) electronic structure of atomic and molecular systems, (2) luminescence and photo-Hall effect of copper-doped Zn S and Cd S crystals, (3) energy levels, magnetic susceptibilities, and electronic structure of atoms in crystal lattices, (4) application of the method of tight binding to energy band calculations. Author (GRA)

N71-18829# Scottish Research Reactor Centre, East Kilbride.
AN ASSESSMENT OF THE INFLUENCE OF Co 60 CONTAMINATION IN STRUCTURAL STEEL OF THE McMASTER UNIVERSITY HEALTH SCIENCES COMPLEX ON THE BACKGROUND COUNTING RATE OF THE PROPOSED SHADOW SHIELD WHOLE-BODY MONITOR
Keith Boddy and Maureen E. Mahaffy [1970] 23 p refs
Supported in part by the Scot. Hosp. Endowments Res. Trust
(SRRC-33/69) Avail: NTIS

Samples of steel used in constructing the McMaster University Health Sciences Complex were examined for known Co-60 contamination. The activity was estimated as about 0.2 pCi/g steel. The contamination effect on the background counting rate of the shadow shield whole-body monitor was simulated. The increase over background counting-rates was measured in 8 energy bands. It was concluded that excess counting rates over background are unlikely to be statistically significant and should not affect the monitor performance. Author

N71-18847# Strathclyde Univ., Glasgow (Scotland). Dept. of Mechanical Engineering.
MULTIGROUP NEUTRON TRANSPORT EQUATION IN THE DIFFUSION AND P1 APPROXIMATION
D. Obradovic (Boris Kidric Inst. of Nucl. Sci., Belgrade) East Kildride, Scot. Scot. Res. Reactor Centre [1970] 32 p refs
Sponsored by IAEA
(SRRC-35/69) Avail: NTIS

Investigations of the properties of the multigroup transport operator, with and without delayed neutrons in the diffusion and P1 approximation, is performed using the Keldish theory of operator families as well as a technique recently used for investigations into the properties of the general linearised Boltzmann operator. It is shown that in the case without delayed neutrons, the multigroup transport operator in the diffusion and P1 approximation possesses a complete set of generalised eigenvectors. A formal solution to the initial value problem is also given. Author

N71-18849# Rome Univ. (Italy). Ist. di Fisica.
POSITIVITY CONDITIONS FOR VELOCITY-DEPENDENT AND QUADRATIC-SPIN-ORBIT POTENTIALS
F. Calogero and Yu. A. Simonov 7 Jul. 1970 9 p refs
Submitted for publication Prepared in cooperation with Acad. of Sci. (USSR), Moscow *Its* Nota Interna No. 276
Avail: NTIS

It is proved that, if velocity-dependent and quadratic-spin-orbit potentials are present, they must satisfy very restrictive positivity conditions; otherwise, the many-body Hamiltonian has a spectrum that is not bounded below. These conditions are not fulfilled by several currently available nuclear potentials. Author

N71-18850# Rome Univ. (Italy). Ist. di Fiscia.
EFFECTIVE FOUR BODY INTERACTION IN LIGHT NUCLEI
P. Camiz, A. D'Andrea, E. Olivieri, and M. Scalia 22 Jul. 1970 11 p refs Supported by CNR *Its* Nota Interna No. 279
Submitted for publication
Avail: NTIS

The nuclear binding energies in the shell 1p(3/2), 1d(3/2), 1d(5/2) and 1f(7/2) were calculated with a mass formula including generalized pairing interaction and an effective four-body interaction acting between nucleons coupled to J = 0 and T = 0. The introduction of the four-body force improves previous results. The correlation between the derived and previous meters is discussed qualitatively. Author

N71-18861# Naval Intelligence Command, Alexandria, Va. Translation Div.
INFORMATION FOR CALCULATIONS OF THE PASSAGE

OF RADIATION THROUGH INHOMOGENEITIES IN SHIELDING

O. I. Leipunskii et al 3 Dec. 1970 53 p refs Transl. into ENGLISH from the book "Prokhozhdenie Cherez Neodnorodnosti v Zashchite" Moscow, 1968 53 p
(AD-715462; NIC-TRANS-3063(A)) Avail: NTIS CSCL 18/6

Calculations of the passage of neutrons through media which do not contain hydrogen are more difficult than the corresponding calculations for hydrogen-containing media. This can be explained by the fact that, in the first place, for very many elements the magnitudes of the neutron cross sections are known to have substantial errors (10-15%), while the differential cross sections for elastic and inelastic scattering have only been investigated within finite energy ranges. Therefore, solutions of practical problems which involve the passage of neutrons through media which do not contain hydrogen are obtained by using the purely experimental information which has been accumulated to date. Author (GRA)

N71-18868# Institute of Nuclear Research, Warsaw (Poland).
NUCLEAR DATA RESEARCH IN POLAND Progress Report, May 1969 – Apr. 1970

Andrzej Marcinkowski, comp. 1970 40 p refs
(INR-1197) Avail: AEC Depository Libraries

Research conducted in the field of neutron physics is reported. Abstracts and summaries of individual projects are presented and include: (1) investigation of the nuclear surface by means of /n, alpha/ reactions; (2) energy spectra of alpha particles from the /n, alpha/ reactions induced by 14.2 MeV neutrons in dysprosium isotopes; (3) measurements of high energy gamma ray spectra in strong neutron flux; (4) excitation of short-living isometric activities in Se-77, Sb-122, Ba-137, Er-167, and Hf-179 using 14.4 MeV neutrons; (5) estimation of the quality factor /QS/ in tissue-like phantom irradiated with 14.8, 5.0, and 3.3 MeV neutrons; (6) penetration of a two-dimensional fission barrier; and (7) cross sections for various reactions in the neutron energy range of 13 to 18 MeV. D.L.G.

N71-18879# Illinois Univ., Urbana. Dept. of Physics.
EFFECTS OF SPIN IN MULTIPLE QUARK SCATTERING ANALYSIS OF PROTON-PROTON SCATTERING

W. C. Thacker Jan. 1971 36 p refs
(Grant NSF GP-25303)
(ILL-(TH)-71-3) Avail: Issuing Activity

Proton-proton scattering is investigated in a model in which the protons are composed of quarks and the scattering is due to multiple collisions of the quarks. By including spin in the calculation it was hoped that the differential cross section data could be described without resorting to quark amplitudes with t-dependent phases to remove dips which appear in the calculation. The conclusion is that the dips persist even when spin effects are included. Author

N71-18880# Illinois Univ., Urbana. Dept. of Physics.
ASYMPTOTIC BEHAVIOR OF THE VERTEX FUNCTION IN QUANTUM ELECTRODYNAMICS

Paul M. Fishbane and J. D. Sullivan Jan. 1971 60 p refs
(Grant NSF GP-25303)
(ILL-(TH)-71-1) Avail: Issuing Activity

Using recently developed infinite momentum techniques, the asymptotic behavior of the three-point function in quantum electrodynamics (massive photons) is studied by summing the leading behavior of the perturbation series. The leading diagrams are those in which photons are exchanged in all permutations across the external photon insertion. When the fermion lines are on-shell, an earlier speculation based on a fourth order calculation is confirmed. In a fashion reminiscent of eikonalization in a scattering process, a quantity Phi in the vertex function is characteristic of single photon exchange across the vertex. A fourth order contribution to Phi coming from vacuum polarization is identified and computed. The concept of infinite momentum pathways and the possibility of exponentiation in scalar theories are discussed. Author

N71-18883 California Univ., Los Angeles.
AN ARC HEATED AR-HE BINARY SUPERSONIC MOLECULAR BEAM WITH ENERGIES UP TO 21 eV

Wen-Shean Young (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-2280

A molecular beam apparatus combining the aerodynamic acceleration and arc heating techniques was developed. Semi-empirical equations which predict the beam density and the beam energy were derived. The phenomenon of species separation associated with expansions of a binary mixture in a free jet and thermal diffusions due to arc heating is also investigated. To facilitate the experimental studies, a magnetoplasma dynamic arc heater was developed. To eliminate some of the deficiencies of a conventional single disk time-of-flight (TOF) chopper, a novel dual disk TOF chopper was introduced. Analytical expressions relating the dual disk TOF signals to the density and the pertinent parameters of the speed distribution function of the beam were derived. Dissert. Abstr.

N71-18915# Reactor Instituut, Delft (Netherlands).
SLOW ELECTRONS AND NEGATIVE IONS IN ORGANIC LIQUIDS

A. Hummel [1970] 19 p refs Presented at the 4th Intern. Congr. of Radiation Res., Evian, France, 28 Jun.–4 Jul. 1970 Submitted for publication
(IRI-133-70-02) Avail: NTIS

A simplified model of the behavior of the charged entities in the track of a fast electron slowing down in the liquid, based on a predominant contribution of pairs of charged species that can be treated with classical diffusion theory, is discussed. Comparison of the theory with results from measurements of the electric conductance of liquids under irradiation, and from the observation of ions formed during a short burst of irradiation, yields information about the spatial distribution and the behavior of the charged species in the track of a fast electron. Author

N71-18941# National Lead Co. of Ohio, Cincinnati.
GIRLS: GENERAL INDEXING IN RECIPROCAL LATTICE SPACE

R. W. Hill Nov. 1970 25 p refs
(Contract AT(30-1)-1156)
(NLCO-1066) Avail: NTIS

A computer program for indexing X-ray powder patterns regardless of symmetry is reported. As many as 100 X-ray reflections may be indexed. The program is written in Fortran 4 for a Honeywell 200 computer. A typical run requires about 45 minutes. Aughor (NSA)

N71-19061# Joint Publications Research Service, Washington, D.C.
MICRODISTRIBUTION OF ABSORBED DOS IN THE TRACK OF A HEAVY CHARGED PARTICLE

Ye. I. Kudryashov et al *In its* Space Biol. and Med., Vol. 4, No. 5, 1970 7 Jan. 1971 p 51 - 57 refs (See N71-19051 08-04)
Avail: NTIS

According to several estimates, the fraction of the energy scattered by delta-electrons is 0.3 to 0.6 of the total energy lost by the charged particle. To refine these data, computations were made for different energies of the initial particle and several hypothetical minimum energy levels for delta-electrons. Author

N71-19092 Rochester Univ., N.Y.
EVIDENCE FOR ANGULAR MOMENTUM FRACTIONATION IN THE DECAY OF COMPOUND NUCLEI
Warren John Lyman (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-2889

In the reactions in which an alpha particle is emitted, the use of a Gaussian distribution of recoil velocities led to a better and generally a more reasonable fit to the measured angular distributions than the use of a Maxwellian form or the theoretically calculated spectra. In the reaction in which only neutrons and protons are emitted, the use of a Maxwellian distribution of recoil velocities gave a better and more reasonable fit than did the other two forms. A method of analysis which uses the mean square tangent of a measured product angular distribution to yield the total average energies for emitted particles, T sub n, and photons, T sub gamma is reviewed, and found to be inadequate for analysis of the reactions investigated in this work. Dissert. Abstr.

N71-19093 Stanford Univ., Calif.
CONFIGURATION INTERACTION WAVE FUNCTIONS AND THE PROPERTIES OF ATOMS AND DIATOMIC MOLECULES
Henry Frederick Schaefer, III (Ph.D. Thesis) 1969 352 p
Avail: Univ. Microfilms: HC $16.00/Microfilm $4.50 Order No. 70-1598

A discussion is presented of the restricted Hartree-Fock method for the theoretical description of the electronic structure of atoms and molecules. A number of extensions of the restricted Hartree-Fock or one-electron approximation are also discussed. The more general method of configuration interaction is then examined as a means of understanding in more detail the quantum mechanics of atoms and molecules. Results of configuration interaction calculations on first row atoms and ions and on the low-lying states of the oxygen molecule are presented and discussed. These calculations include studies of the correlation energy of the boron atom, the hyperfine structure of first row atoms, electron affinities of atoms, and potential energy curves for the oxygen molecule. In the course of this work, two new types of configuration interaction wave functions, the polarization wave function and the first-order wave function, were introduced Dissert. Abstr.

N71-19102# David Sarnoff Research Center, Princeton, N.J. Electro-Optics Lab.
TRANSMISSION SECONDARY EMISSION (TSE) MULTIPLIERS USING HIGH GAIN SECONDARY EMITTERS
Final Report, 23 Jun. 1969 – 26 Jun. 1970
R. U. Martinelli 25 Aug. 1970 52 p refs
(Contract AT(30-1)-4100)
(NYO-4100-3) Avail: NTIS

The development of negative electron affinity Si transmission secondary emission (TSE) dynodes to be used in fast photomultiplier structures is discussed p(+)-Si single-crystal samples were activated to a state of negative electron affinity. Photoemission responses of 490 microampere/1m were observed, which implied an escape depth for minority electrons of 5 to 7 microns. From the energy distribution of the photoemitted electrons, it was deduced that the vacuum level at the negative affinity surface lies about 0.2 eV below the conduction band minimum in the bulk. Using thin p(+)-Si samples 3 to 10 microns thick, TSE gains of 50 at 5 keV, 200 at 10 keV, and 725 at 20 keV primary electron energy were observed. Peak reflection mode secondary emission yields of 950 at 20 keV primary electron energy were also measured. Analysis of the data indicates that the TSE gains are greatly decreased by very high surface recombination at the entrance surface. Nonetheless, the very high gains achieved from thin negative affinity p(+)-Si samples make Si ideally suited as a TSE dynode material. Author

N71-19103# California Univ., Livermore. Lawrence Radiation Lab.
FREE-RADICAL MICROWAVE ROTATIONAL SPECTROSCOPY WITH A RESONANT CAVITY
Lawrence W. Hrubesh (Ph.D. Thesis – Wyo. Univ.) 16 Jul. 1970 63 p refs Sponsored by AEC
(UCRL-50890) Avail: NTIS

A Zeeman-modulated resonant cavity spectrometer was specifically designed and constructed to search for microwave rotational absorption spectra of gas-phase free radicals. A Fabry-Perot microwave resonator was used as the absorption cell for the system. The extremely high quality factor (>15,000) for the resonance of such a structure gives it a large effective absorption path length for molecular absorption with a subsequent increase in sensitivity over ordinary spectrometers having short lengths of waveguide as the absorption cell. The cavity itself also offers a direct means to frequency sweep and frequency stabilize a voltage-tunable microwave generator (BWO). The theory of a gas-filled resonant cavity is discussed as well as the optimization of the inherent characteristics of such a resonator, particularly its sensitivity. It is shown that for nearly optimum conditions, the K-band cavity resonator spectrometer is capable of measuring absorptions as weak as 0.23 × 10 to the minus 11th power/cm with simple phase-sensitive detection techniques. A complete description of the electronic system used for the spectrometer is given, with emphasis on the technique used. Author

N71-19104# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.
EXACT BOUNDS ON TRANSPORT COEFFICIENTS
Sam Krinsky and Jerome K. Percus Jul. 1970 109 p refs
(Contract AT(30-1)-1480)
(NYO-1480-160) Avail: NTIS

The Kubo transform technique for calculating transport coefficients by way of space-time correlation functions is discussed. The space-time correlation functions are evaluated by a special path integral formulation. The idea is applied to a model chain of oscillators and a second such system with different parameters. A simple exact inequality for the self-diffusion coefficient is obtained. A direct comparison between an ordinary perturbation expansion, to the first order, for a potential of the quartic interaction type and a perturbation, to a like order, in the path integral formulation, for the same interaction, is made. The two methods are seen to give the same result following a renormalization procedure. The path integral representation is also used to discuss the N-body problem of transport in a Debye-type crystal with nearest neighbor cubic forces. Author

N71-19105# Oak Ridge National Lab., Tenn.
PROGRAM WEIGHT: A FORTRAN 4 PROGRAM FOR EVALUATION OF WEIGHTING FUNCTIONS USED IN SMALL-ANGLE X-RAY SCATTERING
Mary G. Buchanan and Robert W. Hendricks Nov. 1970 65 p refs Revised
(Contract W-7405-eng-26)
(ORNL-TM-1950-Rev-1) Avail: NTIS

A FORTRAN 4 program is presented which evaluates the weighting functions needed to correct observed small-angle X-ray scattering data for the smearing effects of the collimation system. Moments of the weighting functions about both the origin and the mean may also be computed. Author

N71-19113 Rochester Univ., N.Y.
EXPERIMENTAL DETERMINATION AND STATISTICAL-MODEL ANALYSES OF EXCITATION

FUNCTIONS AND RECOIL ION RANGES FROM REACTIONS INDUCED IN AU 197 BY 19 TO 100 MeV He 4 IONS
Frank Michael Lanzafame (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-2887

Reactions induced in Au197 with 19 to 100 MeV He4 ions have been investigated. Excitation functions and thick target recoil ion ranges are reported for the production of Tl200, Tl199, Tl198, Tl197, Tl196, Tl195 and Au196; excitation functions are reported for the production of Au198, Au195, Au194, Hg197m, and Hg195m. The thallium excitation functions appear to be predominantly compound nuclear in the vicinity of their maxima, as evidenced by their competitive nature and the agreement of the recoil ion ranges with the theoretical predictions based on the range theory of Lindhard, Scharff and Schiott, calculated with the assumption of full momentum transfer in the reaction. These excitation functions represent the major portion of the total reaction cross section and, for a given reaction, rise from the threshold to a maximum and then decrease with a significant high energy tail. Dissert. Abstr.

N71-19137*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
A DENSITY MATRIX APPROACH TO MULTICONFIGURATION CALCULATIONS
John E. Harriman Jan. 1970 15 p refs Presented at the Intern. Symp. on Atomic, Mol. and Solid State Theory and Quantum Biol., Sanibel Island, Fla., Jan. 1970
(Grants NGL-50;002-001; NSF GP-12832)
(NASA-CR-116885; WIS-TCI-378) Avail: NTIS CSCL 20H

Density matrix components are determined for a wave function of multiconfiguration type. The array containing information required to obtain the two-electron change density matrix can also be used to construct the N-electron (spin-free) Hamiltonian configuration interaction matrix from the two-electron reduced Hamiltonian matrix. The array can be obtained in several ways and suggests a useful conceptual organization. Author

N71-19150# Oak Ridge National Lab., Tenn. Reactor Div.
REVIEW OF THE ORNL FUSION FEASIBILITY STUDIES
Don Steiner Dec. 1970 31 p refs Presented at the ORNL Thermonucl. Div. Ann. Inform. Meeting, Oak Ridge, Tenn., 21–22 Sep. 1970 and at the 5th Intersoc. Energy Conversion Eng. Conf., Energy 70, Las Vegas, Nev., 21–25 Sep. 1970
(Contract W-7405-eng-26)
(ORNL-TM-3222) Avail: NTIS

The conceptual fusion reactor is described; then, the scope of the ORNL studies is discussed briefly; investigations in the areas of radiation damage, environmental considerations, and alternate fuel cycles are discussed; finally, the direction of the ORNL studies for the coming year is indicated. Author (NSA)

N71-19158# Sandia Corp., Albuquerque, N.Mex.
MECHANISM OF THERMAL DISSOCIATION OF DIATOMIC MOLECULES
S. A. Losev et al Mar. 1970 10 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), no. 6, 1970 p 30–34 Sponsored by AEC
(SC-T-70-4045) Avail: NTIS

Dissociation directly associated with the process of exciting molecular oscillations is analyzed. Dissociation process related to Boltzmann distribution interference is examined in both the upper and lower levels of excitation. A problematic sketch of molecular dissociation comprising a small admixture to the inert diluent is solved using Fokker-Planck equation, quasi-stationary values, and diffusion coefficient. J.A.M.

N71-19167# National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
DETERMINATION OF STRESSED AND DEFORMED STATES IN LIGHT METALS UNDER NEUTRON IRRADIATION [OB OPREDELENII NAPRYAZHENNOGO I DEFORMIROVANNOGO SOSTOYANIYA V LEGKIKH METALLAKH PRI OBLUCHENII NEITRONAMI]
A. G. Zhuravlev 1970 13 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat. i Mekhan. (Moscow), 1961 p 54–58 Prepared in cooperation with NBS
(TT-70-57064; DMDC-4016) Avail: NTIS CSCL 20L

Irradiation of a substance by a beam of neutrons gives rise to a number of complicated structural changes and transformations, of which some are primary changes and the remaining secondary. Interaction between high-energy radiation and the substance is a cascade process consisting of the appearance of primary effects, their further development and propagation. In the case of neutron irradiation, the primary effects include the displacement of atoms from lattice corners, excitement of atoms and electrons not leading to their displacement and nuclear transformations. Ionization in this case is the secondary effect. Author (GRA)

N71-19182 Oregon Univ., Eugene.
BOUND STATE AND UNSTABLE PARTICLE SCATTERING IN MODEL QUANTUM FIELD THEORY
Tsu-huei Liu (Ph.D. Thesis) 1969 276 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.55 Order No. 70-2522

The V-2 theta sector and also the higher V-n theta sector within n > 2 of the Lee model are investigated. An iterative expansion technique is developed for solving the Green's functions in these sectors. The iterative expansion is constructed so that each term of the series preserves all the properties of the (V theta) bound state, the analytic structure and the symmetries of the Green's function. Two types of unstable particles are discussed: unstable elementary particles and unstable composite states. These unstable particles are illustrated by means of the Lee model and a modified form of it. The mass and lifetime of the unstable elementary V particle in the modified Lee model and those of the unstable (V theta) composite state are determined by the position of the complex pole. The different ways of calculating the renormalization constant for the unstable particle are discussed. Dissert. Abstr.

N71-19183 Rensselaer Polytechnic Inst., Troy, N.Y.
RESONANT SCATTERING FROM INHOMOGENEOUS NONSPHERICAL TARGETS
Edwin David Reilly, Jr. (Ph.D. Thesis) 1969 248 p
Avail: Univ. Microfilms: $11.25/Microfilm $3.20 Order No. 70-2639

A method is proposed for solving scattering problems in which either scalar or vector waves impinge at an arbitrary angle on inhomogeneous nonspherical targets whose dimensions are comparable to the wavelength of the incident radiation. This method reduces a partial differential equation to an ordinary differential equation through the use of trial functions which purport to represent the complete functional variation of all but one variable, as contrasted to usual variational methods whose trial functions involve all variables. The principal results were derived from application of the method to axially symmetric targets represented in a spherical coordinate system. Dissert. Abstr.

N71-19201 Harvard Univ., Cambridge, Mass.
LONG-LIVED COLLISION COMPLEXES
Sanford Alan Safron (Ph.D. Thesis) 1969 234 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.05 Order No. 69-19801

A crossed molecular beam apparatus is described, which is designed for the study of the A + BX yield AX + B, alkali atom-alkali halide exchange reactions. A quadrupole mass spectrometer (Paul massfilter) is used, together with the differential surface ionization technique, to permit measurements on both products and both reactants. A small, mechanical velocity selector, which can be installed easily, converts the angular distribution detector to a velocity analyzer. The angular distributions of sixteen atom-salt reactions, including six pairs studied in the forward (exothermic) and reverse directions, were measured, with velocity analysis on seven of these. Kinematic analysis of the data indicates that the products in every case recoil symmetrically forward and backward in the system. This implies that the reaction mechanism involves the formation of long-lived collision complex.
Dissert. Abstr.

N71-19202 Utah State Univ., Logan.
NEUTRON SOURCES FOR NEUTRON RADIOGRAPHY
Darrell Claude Cutforth (Ph.D. Thesis) 1969 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 70-2388

Spatial and spectral neutron distributions were calculated for several source-moderator combinations. A small nuclear reactor is the best source for neutron radiography. A reactor has the highest available thermal neutron flux, and both acquisition and operating costs per thermal nv are lower for a reactor than for either isotopic or accelerator sources. Results demonstrate that for those applications where a reactor source cannot be used, either isotopic or accelerator sources can be substituted. However, because of a shortage of thermal neutrons, radiographs made with isotopes and accelerators will be inferior to radiographs made with a reactor. With the same degree of collimation, radiography beams from a small reactor would be at least three orders of magnitude more intense than beams from practical isotopic or accelerator systems.
Dissert. Abstr.

N71-19203 California Univ., Los Angeles.
ENERGY TRANSFERS INVOLVING THERMIONIC PHENOMENA
Dean Leo Jacobson (Ph.D. Thesis) 1969 183 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 70-2220

Experimental investigations of thermionic phenomena were performed with a rhenium electrode-cesium gas filled diode of plane parallel geometry. The interelectrode spacing was variable. The high-pressure diode operating in the ignited mode was analyzed. Voltage output was derived theoretically and compared with some existing experimental data over interelectrode spacings where the maximum power output occurs. An investigation of electrical breakdown was conducted over a range of temperatures from 1300 K to 2000 K, with cesium pressures from 0.053 torr to 6.22 torr and interelectrode spacings varying from 0.001 cm to 0.07 cm. A new mathematical formulation of the experimental Paschen law was made. The equation of continuity was solved with an appropriate breakdown condition and a special form for the ionization cross section. Electron-atom collisions were assumed to be the ionization mechanism with diffusion and drift as the loss mechanisms.
Dissert. Abstr.

N71-19205*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HAMILTONIAN FORMULATION OF GUIDING CENTER MOTION
David P. Stern Feb. 1971 44 p refs Submitted for publication
(NASA-TM-X-65458; X-641-71-56) Avail: NTIS CSCL 20H

The nonrelativistic guiding center motion of a charged particle in a static magnetic field is derived using the Hamiltonian formalism. By repeated application of first-order canonical perturbation theory, the first two adiabatic invariants and their averaged Hamiltonians are derived, including the first-order correction terms. Other features of guiding center theory are also obtained, including lowest order drifts and the flux invariant.
Author

N71-19206 Rensselaer Polytechnic Inst., Troy, N.Y.
A STUDY OF THE V-51 (GAMMA, ALPHA) SC-47 REACTION WITH 40 MeV-60 MeV BREMSSTRAHLUNG BY RECOIL TECHNIQUE
Peter Alexander Wong (Ph.D. Thesis) 1969 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 70-2661

The photo-alpha reaction was studied by the average range and a differential range method. Following irradiation, layers of aluminum catcher foil containing the recoil nuclei were removed. The recoil Sc-47 was radiochemically separated from the stripped layers. The integral activities of the recoil Sc-47 in the target and catcher foils were measured. Experimental results indicate that the reaction occurs almost entirely through the formation of an excited intermediate state of V-51, followed by the evaporation of the alpha particle. The agreement between the forward-backward range and the perpendicular range is considered to be evidence for a predominantly nonpreferential distribution of recoil Sc-47 in the center-of-mass system. Both the energy of the alpha particle and the most probable energy of the photon absorbed by the nucleus agree well with results from other investigations. The results also suggest the possibility of a contribution from a nonstatistical process.
Dissert. Abstr.

N71-19209# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
DIFFICULTY AND POSSIBILITY OF KINETIC THEORY OF QUANTUM-MECHANICAL SYSTEMS. PART 6: SUMMARY, ADDENDA AND CONCLUSION
Toyoki Koga Sep. 1970 24 p refs
(Contracts Nonr-839(38); DAHC04-69-C-0077; ARPA Order 529; ARPA Order 1442)
(AD-715125; PIBAL-70-41-Pt-6) Avail: NTIS CSCL 20/10

The document concludes the series of the reports written thus far under the same title. The conclusion is that quantum-mechanical states are of ensembles. The notion of ensemble is exactly one hundred years old. It was first conceived by Boltzmann in 1871. In this century, the notion has been somehow distorted. The genuine notion has survived barely as anomalous and obscure. This part is a tribute to those anomalous authors who have fought, with no concent of the majority, for the survival of the true notion of ensemble. The author now believes that the point of departure for truly effective physics should be found by recognizing the old notion of ensemble, its merit and the limitation.
Author (GRA)

N71-19211 Stanford Univ., Calif.
DYNAMIC CRACK PROPAGATION ACCORDING TO NONLINEAR ATOMIC SEPARATION LAWS
Daniel William Hovis (Ph.D. Thesis) 1969 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00

The crack propagation process, which is defined as the successive separation of the pairs of atoms at the propagating end of the crack until the forces between them become negligibly small, was studied. A model incorporating the essentially nonlinear behavior was devised by Goodier, and its behavior was worked out by Goddier and Kanninen for internal cracks and by Goodier and Anderson for external cracks extending slowly. The force-separation relations between atoms comprising the body are, with the essential exceptions of the atoms next to the crack plane (the plane midway between the two layers of atoms which are separating), taken as given by linear elasticity theory. An atom next to the crack plane

experiences a nonlinear force from the atom directly opposite on the other side of the crack plane. The principal conclusions are that the displacement and the stress across the crack plane ahead of the crack tip and the intensity of the remote tensile loading, decrease as the speed of the crack increases. The displacement of the crack surface increases as the speed of the crack increases. It grows without bound as the speed approaches the Rayleigh wave speed of the material. Dissert. Abstr.

N71-19229# Rome Univ. (Italy).
POLARIZATION OF THE RECOIL PROTON FROM THE PROCESS GAMMA NEUTRON YIELDS PROTON PION(−) IN DEUTERIUM FOR (theta SUB pi) SUB c.m. APPROXIMATELY = TO 90 DEG IN THE SECOND RESONANCE REGION
M. Beneventano, S. d'Angelo, F. de Notaristefani, P. Monacelli, L. Paoluzi et al 20 Apr. 1970 13 p refs Submitted for publication
Its Nota Interna No. 264
Avail: NTIS

The polarization of the recoil proton from the process gamma + neutron yields proton + pion(minus) in deuterium was measured for pion scattering angles approximately equal to 90 deg and in the incident gamma-ray energy range from 515 to 714 MeV, using the 1.1 Gev Frascati electron synchrotron. The experiment was performed to add data to single photoproduction analysis in the second resonance region. The polarization at 90 deg in the center-of-mass system provides information on the interference terms of opposite parity states. The polarization of the recoil proton at 90 deg is expressed in terms of the multipoles associated with the given possible resonant states. Author

N71-19234# Michigan Univ., Ann Arbor.
CHARGE MOBILITIES IN SUPERFLUID HELIUM UNDER PRESSURE
Burton Alan Brody (Ph.D. Thesis) 1970 125 p refs Sponsored by AEC
(TID-25587) Avail: NTIS

Measurements are presented of the mobilities of positive and negative charge carriers and the ratio of these at each point, at elevated pressures in He-2. The data proceed along ten isotherms at 1.315 to 1.83 K from the vapor pressure to the melting curve, and along cross-hatching isobars at intermediate pressures through the lambda line as well. This mapping extends through the regimes of roton scattering kinetic theory and viscous dynamics, accommodating to various analyses of mobility theories and charge carrier models, and of the roton parameters under pressure. All analyses are not pursued in depth, but almost five hundred mobility data are tabulated and plotted, for each carrier separately and as ratios, against pressure and inverse temperature, to reveal previously unobserved structure. The technique is a measurement of the drift time for charge carriers of either sign, generated by a 0.46 mCi americium alpha source and received by a fast electrometer as a current pulse. Author (NSA)

N71-19235# Sandia Corp., Albuquerque, N.Mex. Reactor Studies Div.
COMPUTATIONAL METHOD FOR CALCULATION OF RADIOLOGICAL DOSE RESULTING FROM HYPOTHETICAL FISSION PRODUCT RELEASE
Lloyd L. Bonzon and Joseph B. Rivard Jul. 1970 150 p refs
(SC-RR-70-338) Avail: NTIS

An improved method for the calculation of radiological doses resulting from the release of fission products to the environment following a reactor excursion is presented, including the derivation of, and the limitations on, the inhalation dose equation. The method is applied in the linked computer codes FISSP and CLOUD to the calculation of external and internal doses resulting from the hypothetical release and dispersal of 326 fission product nuclides and metastable states. The sensitivity of the results to parameter variation is reported, including a study of the influence of unlisted MPC values upon the inhalation doses. Author (NSA)

N71-19299 Howard Univ., Washington, D.C.
THE ELECTRON AFFINITY AND DIPOLE MOMENT OF C SUB 2v MOLECULES (NH2, H2S)
Alfred Phillips, Jr. (Ph.D. Thesis) 1969 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-2003

A theory is devised which represents molecules of C sub 2v symmetry as a system of three charges having the geometry of the molecule in the ground state, to represent the negative molecular ion. The magnitude of the charge unit, q, of the system is obtained from the dipole moment and the geometry of the molecule. If the dipole moment is known, the electron affinity can be calculated since it is the energy expectation value of an electron in the field of the three charges of the system. When the dipole moment of a molecule of C sub 2v the symmetry is unknown, it can be determined by this model if the electron affinity of the negative molecular ion is known. As a test the systems NH2 and H2S are considered. The dipole moment of NH3 is calculated by making use of the 1.65 eV electron affinity of NH2(−). The electron affinity of H2S is calculated since the dipole moment of this molecule is well known. Dissert. Abstr.

N71-19300*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
SHAPE RESONANCES AND ROTATIONALLY PREDISSOCIATING LEVELS: THE ATOMIC COLLISION TIME DELAY FUNCTIONS AND QUASIBOUND LEVEL PROPERTIES OF H2 (CHI (1 SIGMA g +))
Robert J. Le Roy and Richard B. Bernstein 11 Jan. 1971 48 p refs
(Grants NGL-50-002-001; NSF-GB-16685)
(NASA-CR-116889; WIS-TCI-427) Avail: NTIS CSCL 20H

The energy dependance of the collisional time-delay function was computed for H(1S) atoms interacting via the ab initio H2(X 1 Sigma g +) potential. Peaks in this function determine the scattering resonance energies Er and widths Gamma, and the lifetimes for each of the corresponding quasibound vibrational-rotational levels. Small differences are found between these Er and Gamma, and the values obtained by a maximum internal amplitude approach. Approximate procedures for rapid, accurate numerical evaluation of Er are appraised; a new outer boundary condition criterion for resonances leads to the best agreement with the exact results. Also, a primitive WKB procedure yields Gamma's of usable accuracy. For ground-state H2, HD, and D2, the onset of line broadening due to centrifugal barrier penetration is found to occur at energies some hundreds of 1/cm below the locus of barrier maxima. The predissociation method of estimating long-range interatomic forces therefore cannot be expected to yield valid results for hydridic diatomics. Author

N71-19323 Yale Univ., New Haven, Conn.
KAON(−) PROTON INTERACTIONS AT 12.6 GeV/c
Thomas William Ludlam (Ph.D. Thesis) 1969 244 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 70-2765

These interactions are found to lead predominantly to final states of low multiplicity, with 98% of the total interaction cross section being accounted for by events with 6 or fewer visible stable particles in the final state. Aside from the elastic channel, the reaction with the largest cross section (approximately 1.1 mb) is kaon(−) proton yields antikaon (0 or −) proton pion (0 or +) pion(−). This reaction proceeds largely via quasi-three-body production, leading to the final state kaon*(890) proton pion, kaon

proton rho-meson, Delta-hyperon(++) (1238) kaon(−) pion(−), and is characterized by prominent threshold enhancements in the kaon pion pion and proton pion pion spectra. A study of the kaon pion pion threshold enhancement (Q meson) as one or more resonant states gives results consistent with a single J parity = 1(+) or 2(−) resonant state decaying wholly to kaon*(890) pion or kaon rho-meson. Good agreement is found, for both the kaon* proton pion and kaon Delta-hyperon pion final states, with the predictions of a nonresonant, double Regge pole exchange model for the production. Dissert. Abstr.

N71-19324# Oak Ridge National Lab., Tenn. Thermonuclear Div.
NUCLEAR FUSION RESONANCE REACTIONS OF POSSIBLE CTR INTEREST
J. Rand McNally, Jr. Dec. 1970 7 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3233) Avail: NTIS

Some speculations are presented on possible nuclear fusion resonance reactions which may be of importance to the development of clean controlled thermonuclear reactors of either toroidal or mirror type. Author (NSA)

N71-19326# California Inst. of Tech., Pasadena. A. A. Noyes Lab. of Chemical Physics.
LINEAR H + H2: EXACT AND APPROXIMATE REACTION PROBABILITIES
Aaron Kupperman 1970 18 p refs Presented at Conf. on Potential Energy Surfaces in Chem., California Univ., Santa Cruz, 10–13 Aug. 1970
(CALT-767-P-4-66) Avail: NTIS

The theoretical investigation of reactive collisions between hydrogen atoms and molecules in their various isotopic combinations is discussed. The summarized calculations use a realistic potential energy surface and include an investigation of the effect of reagent vibrational energy on the reaction probabilities, as well as the partitioning of the total energy of the system among translational and internal degrees of freedom of the products. NSA

N71-19335# Mound Lab., Miamisburg, Ohio.
INTRODUCTION TO RADIOCHEMICAL TECHNIQUES
H. W. Kirby 20 Nov. 1970 47 p refs
(Contract AT-33-1-GEN-53)
(MLM-1324) Avail: NTIS

A view of instrumental techniques available to the chemist for analytical purposes is presented. Topics covered include: basic principles, detection of radiation, and practical considerations. NSA

N71-19336# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TIME RESOLVED EMISSION SPECTROSCOPY OF AROMATIC MOLECULES
M. L. West and L. L. Nichols 19 Nov. 1970 10 p ref Presented at the Electron and Atomic Phys. Div. Meeting, Seattle
(Contract AT(45-1)-1830)
(BNWL-SA-3526; CONF-701111-2) Avail: NTIS

Single photon counting techniques were used to study the fluorescence response and time dependence of dilute solutions of benzene in cyclohexane excited by protons and ultraviolet radiation. The emission spectra were identical under the two modes of excitation and corresponded to monomer emission from the first excited singlet state of benzene. However, the decay curves of this singlet state emission were not the same for the two modes of excitation. NSA

N71-19338# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
RETENTION OF Po 210 BY REFRACTORY OXIDES
William H. Hale, Jr. Dec. 1970 27 p refs
(Contract AT(07-2)-1)
(DP-1240) Avail: NTIS

Po-210 is released from the refractory oxide barium cerate at 800 to 1000 C by a volume diffusion process. BaCeO3 is prepared by reacting CeO2 with BaO or Ba(NO3)2 at 700 C, with BaCO3 at 800 C, or with BaO2 at 530 C. Author (NSA)

N71-19341# Wisconsin Univ., Madison. Physical Sciences Lab.
PLASMA MEASUREMENTS IN A LEVITATED PULSED OCTUPOLE
H. K. Forsen, D. W. Kerst, R. A. Breun, A. J. Cavallo, J. R. Drake et al Jun. 1970 4 p Presented at 4th European Conf. on Controlled Fusion and Plasma Phys., Rome Sponsored by AEC
(COO-1726-54; Conf-700817-25) Avail: NTIS

Studies with levitated hoops in a pulsed toroidal octupole were undertaken with gun-injected and microwave-produced plasmas. Density decay rates were less than Bohm, and less with levitated than with supported hoops. Author

N71-19345# Idaho Nuclear Corp., Idaho Falls.
TECHNIQUE FOR ASSAY OF L-10 BOTTLES OF PLUTONIUM NITRATE
J. E. Cline, E. B. Nieschmidt, A. L. Connelly, and E. L. Murri Oct. 1970 29 p ref
(Contract AT(10-1)-1230)
(IN-1433) Avail: NTIS

A technique for the assay of L-10 bottles containing plutonium nitrate has been developed. This method uses nondestructive Ge(Li) gamma-ray spectroscopy and is capable of measuring total plutonium content as well as relative abundances of the Pu-239, Pu-240, and Pu-241 isotopes. Accuracies of about 5% may be obtained for total, Pu-239, and Pu-241 content and of about 10% for Pu-240 content. The assay may be performed quickly and simply by personnel of the particular fuel processing or fabricating plants. Author (NSA)

N71-19350# Oak Ridge National Lab., Tenn.
ELECTRON ATTACHMENT TO POLYATOMIC MOLECULES
A. A. Christodulides (Ph.D. Thesis – Tenn. Univ.) and L. G. Christophorou Dec. 1970 218 p
(Contract W-7405-eng-26)
(ORNL-TM-3163) Avail: NTIS

Interactions of low-energy electrons (below 10 eV) with key polyatomic molecules were studied. Experimental data on dissociative electron attachment to brominated aliphatic hydrocarbons and on nondissociative electron attachment to p-benzoquinone, obtained by the electron-swarm, the electron-beam, and the swarm-beam methods, are presented and discussed within the framework of the resonance scattering theory. Indications were provided from experimental results that the n-C(N)H2(N+1)Br molecules can be treated as diatomic-like molecules as far as the fast production of Br(−) is concerned. Experimental evidence is presented which indicates that electrons can be captured in the field of an excited electronic state of p-benzoquinone forming a long-lived negative ion. In addition, experimental results are presented which provide a comparison of the electron energy distribution functions for the gases Ar, N2, and C2H4. These three gases with the respective electron energy distribution functions tested are suggested as standard carrier gases for electron attachment studies. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-18152# Commissariat a l'Energie Atomique, Grenoble (France).

KINETIC THEORY OF ANOMALOUS DIFFUSION DUE TO A DRIFT DISSIPATIVE INSTABILITY

P. Rolland 1970 3 p Presented at the 14th European Conf. on Controlled Fusion and Plasma Phys., Rome

(CEA-CONF-1596; CONF-700817-21) Avail: AEC Depository Libraries

A kinetic theory of classical and anomalous diffusion is presented, taking into account the average of the quadratic effects associated with the presence of a drift-dissipative instability. The results enable the study of the saturation mechanisms of the instability. Author (NSA)

N71-18153# Commissariat a l'Energie Atomique, Grenoble (France).

NONLINEAR EFFECTS IN TRANSIT TIME MAGNETIC PUMPING

E. Canobbio 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome

(CEA-CONF-1606; CONF-700817-9) Avail: AEC Depository Libraries

The conditions for the validity of the energy absorption of electromagnetic waves by magnetic pumping with transit time as derived by the linear theory were investigated. It is shown that, in very low-beta plasmas, the heating rate is determined by Coulomb collisions rather than by Landau damping. Author (NSA)

N71-18159# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

RF ELECTRON PLUGS AND THEIR POSSIBLE APPLICATION IN THERMONUCLEAR RESEARCH

E. Canobbio, O. De Barbieri, and S. Giuffre 1970 4 p refs Presented at 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1605; CONF-700817-8) Avail: AEC Depository Libraries

The feasibility of increasing plasma lifetime in mirror machines by using resonant rf electron plugs was examined (for comparison the case of rf ion plugs was also briefly considered). An investigation into the basic physical mechanisms involved showed that a net thermonuclear power yield would require efficient plugging of 100 to 150 keV electrons over several hundred of deflections. Author (NSA)

N71-18164# Academy of Sciences (USSR), Moscow. Inst. Fiziki.

SPECTRA OF TURBULENCE OF WHISTLERS IN COLLISIONLESS PLASMA

M. A. Livshits and V. N. Tsytovich 1970 22 p refs In RUSSIAN *Its* Preprint No. 100

(NP-18482) Avail: AEC Depository Libraries

Studies of nonlinear interactions and spectra of stationary turbulence of whistlers (helicons) showed that the law of conservation limited considerably the decay interactions of whistlers although the matrix elements for the whistler decay interactions, exceeded the matrix elements for scattering on ions. Formulas obtained for induced scattering on ions also showed that the stationary solutions corresponded to the whistler energy collapse in the direction of the external magnetic field and formation of one-dimensional spectra. The decay of such waves is strongly forbidden. In the case of prevailing induced scattering on electrons, the stationary spectrum existed only in some specific instances. Disturbance in plasma isothermality may result in propagation of ion–acoustic waves whose interaction with whistlers are capable of changing, significantly, the whistler spectra. NSA

N71-18165# Academy of Sciences (USSR), Leningrad. Fiziko-Tekhnicheskii Inst.

LINEAR TRANSFORMATION AND ABSORPTION OF WAVES IN PLASMA

V. E. Golant and A. D. Piliya 1970 81 p refs In RUSSIAN; ENGLISH summary

(NP-18504) Avail: AEC Depository Libraries

The theory of the linear wave transformation in plasma is considered on the basis of recent works. The coupling of electromagnetic and plasma waves in the region of nonuniform plasma where the cold refractive index has a singularity is analyzed. The conditions for the transformation mechanism to become effective are discussed and a survey of the results on the transformation effectiveness is given. A review is given of experimental results on collisionless absorption of the high frequency waves in the frequency region between the upper and the lower hybrids. (A brief survey of plasma resonances is also included.) Analysis of the experimental data and their comparison with theory indicates that the experimentally observed absorption is accounted for, in a wide variety of conditions, by the linear transformation of the incident electromagnetic wave into a strongly damping plasma wave. The collisionless absorption due to the transformation can be useful in plasma heating experiments aimed at controlled thermonuclear fusion. Author (NSA)

N71-18166# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.

PLASMA FLOW AND THE ASSOCIATED MACROSCOPIC EQUATIONS [EQUATIONS MACROSCOPIQUES ET ECOULEMENTS DE PLASMA]

Pierre Guillaneux [1970] 29 p refs In FRENCH

(CEA-N-1371) Avail: AEC Depository Libraries

The conditions under which the magnetohydrodynamic equations are valid are specified. A more simple theory predicting the possibility of flow of plasma accompanied by a compression is then studied. This theory is applied to the focused phase of the focus discharge. Under conditions of maximum temperature and density the orders of magnitude calculated were comparable with values deduced using various other methods. Author (NSA)

N71-18179# Academy of Sciences (USSR), Moscow.

INFLUENCE OF RESONANCE STRUCTURE OF THE MAGNETIC FIELD ON CONFINEMENT OF COLLISIONLESS PLASMA IN TOR-1 STELLARATOR

E. D. Andryukhina, I. V. Soldatskii, O. L. Fedyanin, and Yu. V. Kholnov 1970 16 p refs In RUSSIAN *Its* Preprint No. 117

(NP-18470) Avail: AEC Depository Libraries

Previously, it was postulated that the rosette structure of magnetic surfaces, shifting, and magnetic axis distortions influence plasma lifetime in the rotational transformation region. The influence of rosette structure of the magnetic field on plasma confinement was studied in order to verify the suggested hypothesis. Compensation of resonance magnetic field perturbations at the point of strong resonance, $i = 2$ pi, was carried out using the Tor-1 stellarator, and the structure of the magnetic field and its influence on plasma confinement were measured. Results show that, although the plasma is very sensitive to changes in magnetic field structure and its distribution along the cross section of the chamber changed with changes of magnetic surface, the main integral characteristics of plasma confinement remained unaltered. However, before making any final decision on the influence of field structure on plasma confinement, it is necessary to determine the character of plasma currents on the walls. NSA

N71-18180# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

DENSITY MEASUREMENTS USING A LANGMUIR PROBE

IN THE PRESENCE OF A MAGNETIC FIELD [MESURE DE DENSITE PAR SONDE DE LANGMUIR EN PRESENCE DE CHAMP MAGNETIQUE]

Jacqueline Ripault-Misguich May 1970 154 p refs In FRENCH
(EUR-CEA-FC-540) Avail: AEC Depository Libraries

An electron collection model was established using a plane probe placed parallel to the magnetic field. This model takes into account electron trajectories in the plane of the probe. The region in which the model is valid is limited by the large dimensions of the probe compared to the Larmor electron radius and the large mean free paths of the electrons and ions in comparison with the probe dimensions. In this domain, various limitations on the use of the probe were encountered due to the flatness of the probe, which must be within one Larmor electron radius, and to the finite response time of the plasma which limits the recording time of a characteristic. The measurement of N and T sub e was independent of any hypotheses on the value of the ionic temperature. This fact could not be envisaged had the probe been placed perpendicular to the magnetic field. Author (NSA)

N71-18181# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France) Centre d-Etudes Nucleaires.

MAGNETIC CONFIGURATION IN A CIRCULAR QUADRUPOLAR WELL: DECA 2 B [UNE CONFIGURATION MAGNETIQUE EN PUITS QUADRUPOLAIRE CIRCULARISE: DECA 2 B]

P. Lecoustey and J. Tachon Aug. 1970 35 p refs In FRENCH
(EUR-CEA-FC-554) Avail: NTIS

The plasma confinement equipment of Deca 2 B is described. A method of focusing the magnetic lines outside the confinement zone was sought by placing on each side of the quadrupolar field two other quadrupolar coils in opposition with the first ones, which ensures plasma stability. This method was called circularization. The object of the experiment was to study the confinement of a relatively dense plasma when charge-exchange losses are not dominant. Author (NSA)

N71-18188# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d-Etudes Nucleaires.

INTERACTION OF A LASER-PRODUCED PLASMA WITH A UNIFORM MAGNETIC FIELD

J. P. Bayard, J. P. Boujot, M. Mattioli, and J. L. Soule Jul. 1970 20 p refs
(EUR-CEA-FC-548) Avail: AEC Depository Libraries

The interaction of a laser-produced plasma with a uniform magnetic field is treated numerically; the plasma motion is described by a one-fluid model, the geometry has cylindrical symmetry and axial losses are taken into account. Numerical computations were performed for plasmas having initial parameters similar to those obtained experimentally with LiH pellets. The results are compared with previously published computations and experimental results. Author (NSA)

N71-18189# Academy of Sciences (USSR), Moscow.

RECORDING OF PLASMA OSCILLATIONS INDUCED BY EXTERNAL SUPER-HIGH-FREQUENCY FIELD

G. M. Battanov, K. A. Sarksyan, and V. A. Silin 1970 12 p refs In RUSSIAN *Its* Preprint No. 92
(NP-18471) Avail: AEC Depository Libraries

A probe for measuring potential plasma oscillations in the presence of intense external superhigh frequency fields is described. The probe is screened from the external SHF field by means of a section of an open coaxial line. Plasma oscillations induced in an inhomogeneous plasma layer by strong SHF waves were studied. Plasma oscillations in the omega sub omicron approximates omega sub Le region were recorded and, in the case of a strong external field in the region omega sub omicron > omega sub Lei, the frequency of the plasma oscillation signal coincided with the frequency of the external radiation omega sub omicron. Author (NSA)

N71-18235# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

EXPERIMENTAL PROOF OF MIRROR INSTABILITIES IN THE THETA-PINCH ISAR 1

M. Kaufmann, J. Neuhauser, and H. Roehr Feb. 1970 39 p refs In GERMAN
(IPP-1/105) Avail: AEC Depository Libraries

The variation of the plasma parameters over a wide range showed that the m = 0 instabilities only occurred in sufficiently hot and thin plasmas, and so they are most probably due to the anisotropic pressure of the ions and should be mirror instabilities. Perturbations of the plasma limited in space and time were observed by measurement of the continuum radiation, 90 deg laser scattering, measurement of the magnetic field, and by measurement of the local neutron rate. All measurements showed distinct, correlated, local perturbations of the plasma cylinder. Such perturbations were accompanied by bulging of the plasma cylinder and increasing density. The extension in the axial direction was of the order of the plasma diameter. It may be assumed that the observed instabilities contribute appreciably to the relaxation of the anisotropic ion pressure and increase the end losses. Author (NSA)

N71-18250# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

NUMERICAL CALCULATIONS OF THE DENSITY AND TEMPERATURE VARIATIONS IN CYLINDRICAL PLASMAS PREIONIZED BY UV RADIATION

M. Keilhacker May 1970 22 p refs
(IPP-1/106) Avail: AEC Depository Libraries

To get a picture of the time evolution of density, electron temperature, and ion temperature in cylindrical plasmas preionized by uv radiation, the relevant set of coupled differential equations is solved numerically. The model takes into account energy equipartitioning between electrons and the initially cold ions, radial ambipolar diffusion and heat conduction, and collisional ionization, excitation, and recombination. As an example, numerical results are presented for boundary conditions resembling those of the uv preionization of hydrogen and argon in a large diameter (2R = 40 cm) theta pinch. These show that the characteristic times for radial ambipolar diffusion and heat conduction can be made large relative to the energy-equipartition time by superposing an axial magnetic field of the order of 100 gauss. The energy losses due to collisions with the neutral gas reduce the equilibration temperature by roughly 10%. Author (NSA)

N71-18251# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

EXPERIMENTAL STUDY OF ELECTRON CYCLOTRON HARMONIC WAVES IN A MAGNETICALLY CONFINED LOW-PRESSURE GAS-DISCHARGE

A. Clinckemaillie Nov. 1969 72 p refs In GERMAN
(IPP-2/84) Avail: AEC Depository Libraries

The dispersion characteristics (frequency, wavelength) of electron cyclotron harmonic plasma waves (Bernstein waves) that propagate perpendicular to the magnetic field confining the positive column of a low-pressure argon gas discharge are studied. The waves are excited with small-amplitude, radio-frequency signals applied to a small-wire antenna; the wave-signal detection is done with another similar antenna connected to a superheterodyne receiver (transmission measurements). The experimental results show that, for a constant magnetic field and given frequencies, the longitudinal plasma waves propagate freely across the radially inhomogeneous plasma column with wavelengths that are functions only of the local plasma parameters. Author (NSA)

N71-18266# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
THE COLLECTION OF POSITIVE IONS BY MEANS OF SCREENED PROBES
V. Joshi Aug. 1969 22 p refs
(IPP-2/83) Avail: AEC Depository Libraries

Using a multiple-grid probe, it was possible to separate the currents flowing from the plasma to the collector into their electron and ion components. These studies were made mainly in a thermal cesium plasma obtained by means of contact ionization on a plane tantalum plate. In this plasma the retardation part of the ion current curve plotted as a function of the probe potential was found to be exponential, thus indicating a Maxwellian velocity distribution of the ions. It was possible to evaluate the ion temperature from the slope of the retardation part of the ion curve. This curve was followed by a distinct saturation of the ion current to the collector. The ratio of electron-to-ion saturation current obtained by these measurements was very close for cesium. The ion and electron temperatures determined from the probe characteristic were in the vicinity of the temperature of the hot emitter plate, which was at about 2500 K. Author (NSA)

N71-18267# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NONLINEAR ELECTROSTATIC INSTABILITIES IN A MAGNETOPLASMA
J. A. Tataronis and J. Teichman 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970
(CEA-CONF-1615; CONF-700817-24) Avail: AEC Depository Libraries

The existence of nonlinear instabilities in plasmas and the characteristics of parametric amplification of waves are discussed for the case of asymmetric coupling coefficients. Author (NSA)

N71-18268# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
INTERFEROMETRIC AND SCHLIEREN MEASUREMENTS OF THE ELECTRON DENSITY IN ARC PLASMAS USING IR RADIATION FROM A CO2 LASER
Fritz Keilmann Mar. 1970 104 p refs In GERMAN
(IPP-4/4) Avail: AEC Depository Libraries

The dielectric behavior shows that ions, neutral particles, temperature, and the velocity distribution have little influence on this radiation. Experimentally, such measurements have only recently been made possible by the advent of new techniques in the fields of the CO2 laser, infrared optics, and infrared image conversion, especially with liquid crystals. The electron distribution in rotational symmetric plasmas can be obtained from the phase shift or beam deflection. Five measuring methods and the relevant evaluation procedures are described. Since the characteristic of the image converter cannot readily be calibrated, imaging methods, viz. conventional interferometric and Schlieren systems, yield somewhat less accurate results but require only a very short exposure time. Finally, with certain assumptions, a one-dimensionally focusing deflection method with this exposure time gives directly the electron density distribution along the arc axis. Author (NSA)

N71-18382# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
PREIONIZATION FOR COLLISIONLESS SHOCK WAVE EXPERIMENTS BY MEANS OF PHOTOIONIZATION
M. Keilhacker, F. Pecorella, and G. C. Vlases Dec. 1969 50 p refs
(IPP-1/99) Avail: AEC Depository Libraries

Strong ultraviolet radiation emitted from a dynamically filled linear z pinch in xenon is used to ionize low-density molecular hydrogen and the noble gases. The technique can be used to produce an initial plasma with electron densities of 10 to the 12th power to 10 to the 14th power/cu cm suitable for collisionless shock wave experiments. The degree of ionization that can be achieved at the center of a 150-cm-long test chamber having one light source at each end ranges at 1 mtorr filling pressure from 20% in H2 to 63% in xenon. The plasma is relatively homogeneous, current- and impurity-free, and has an electron temperature of about 1 eV. To determine the space-time dependence of density, electron temperature, and ion temperature in the photoionized gas, the relevant set of coupled differential equations is solved numerically. The calculations show that for conditions resembling those of the experiment the energy equipartition time between electrons and ions can be made shorter than the times for radial diffusion and heat conduction by superimposing an axial magnetic field on the order of 100 gauss. Author (NSA)

N71-18383# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaire.
QUASIPERIODICITY PROPERTIES OF PARTICLE MOTION IN rf SUPPLEMENTED TRAPS
G. Ichtchenko 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970
(CEA-CONF-1599; CONF-700817-17) Avail: AEC Depository Libraries

Plasma confinement in a RF supplemented magnetic trap was studied in the single-particle approximation. The conditions for quasi-resonant and for exact-resonant interaction were determined. The mean energy exchange between particles and field was computed as a function of the initial velocity. The influence of elastic collisions on particle confinement was studied by introducing random deflections of the velocity vector. Author (NSA)

N71-18387# Commissariat a l'Energie Atomique, Grenoble, (France).
SIMULATION OF RF HEATING AND CONFINEMENT OF A PLASMA (COMPUTER-FILM)
J. L. Shohet 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome
(CEA-CONF-1617; CONF-700817-23) Avail: AEC Depository Libraries

A computer model of a plasma was used to demonstrate electron cyclotron heating and confinement by means of electromagnetic waves. The basic problem was to solve the Poisson equation for the self-consistent electric field and then add in the external RF field. The particles making up the plasma were then moved by solving their equations of motion simultaneously by means of a finite difference scheme. Heating and confinement could be shown effectively. Author (NSA)

N71-18388# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
NEUTRON YIELDS AND ENERGY SPECTRA FOR HOT DEUTERIUM-TRITIUM PLASMAS
G. Lehner and F. Pohl Mar. 1970 21 p refs
(IPP-1/107) Avail: AEC Depository Libraries

The use of deuterium-tritium instead of deuterium plasmas was studied to improve neutron diagnostics, because the neutron production rate would be appreciably larger (by a factor of approximately 100). Neutron production rates and energy spectra are given for various velocity distributions of the deuterons and tritons in a hot plasma. Author (NSA)

N71-18394# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

NUMERICAL INTEGRATION METHODS OF THE VLASOV EQUATION

Glen Joyce, George Knorr, and Homer K. Meier (ORNL) 1970 17 p refs

(Contract AT(11-1)-2059)

(COO-2059-6; Rept-70-21) Avail: NTIS

The methods of integrating the nonlinear Vlasov equation are reviewed and compared, and interrelations are investigated. Another method is given that allows a truncation of the resulting infinite matrix without causing numerical instabilities. Its application to the linear and nonlinear Vlasov equation is discussed. It is shown that the cause for numerical instability is based on approximating a continuous eigenvalue spectrum by a discrete spectrum. Author (NSA)

N71-18395# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

DIFFERENCE SCHEME FOR VLASOV'S EQUATION

Juergon Nuehrenberg Jul. 1970 59 p refs

(Contract AT(11-1)-2059)

(COO-2059-5) Avail: NTIS

A difference scheme is developed for the solution of the initial-value problem for the one-dimensional Vlasov equation for a collisionless electron plasma with a homogeneous ion background. Instead of the distribution function itself, its Fourier transform with respect to velocity is used. Case studies of nonlinear Landau damping, a stationary equilibrium, and a two-stream instability are presented as preliminary applications. Author (NSA)

N71-18494# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

ELECTRON CURRENT AND DISTRIBUTION FUNCTION ASSOCIATED WITH AN ELECTRON PLASMA WAVE

M. Guillemot, J. Olivain, F. Perceval, A. Quemeneur, and J. Scharer 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1600; CONF-700817-15) Avail: AEC Depository Libraries

The second-order time-independent electron current and distribution function were derived theoretically and measured experimentally. The results show that there is a deformation in the vicinity of the phase velocity of the wave. This deformation is related to the wave amplitude, wave spectrum, and distance from the source. NSA

N71-18500# Princeton Univ., N.J. Plasma Physics Lab.

ANOMALOUS HEATING OF PLASMAS DRIVEN BY A LARGE TRANSVERSE FIELD AT APPROXIMATELY 2 omega SUB pe

W. L. Kruer and J. M. Dawson Nov. 1970 13 p refs

(Contract N00014-67-A-0151-0021)

(AD-715073; PPL-NP-1) Avail: NTIS CSCL 20/9

Numerical experiments on a plasma driven by a large-amplitude transverse field oscillating at nearly twice the electron plasma frequency are presented. The large wave drives unstable the electrostatic electron plasma waves. When these unstable waves grow to large amplitude, they efficiently transfer energy to the plasma particles. We offer a simple theory to explain the results. Author (GRA)

N71-18505# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

NUMERICAL SOLUTIONS OF THE FULL WAVE EQUATIONS IN AN INHOMOGENEOUS COLD PLASMA SLAB NEAR THE LOWER HYBRID RESONANCE

V. Agnello, D. Columbant, P. Fieffe-Prevost, G. Ichtchenko, and S. Kulinski 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug.–4 Sep. 1970

(CEA-CONF-1613; CONF-700817-3) Avail: AEC Depository Libraries

The absorption of an electromagnetic wave in an inhomogeneous cold plasma slab is considered. For perpendicular incidence, the absorption coefficient presents sharp geometric resonances and depends strongly on the length of the region of evanescence. The case of oblique incidence is then discussed. The resistive loading of a coil imposing an axial wavelength was computed when the accessibility condition is fulfilled. It was found that this resistance varies little with density gradient and that the lower hybrid resonance may be masked by coupling resonances. Author (NSA)

N71-18507# New York Univ., N.Y. AEC Computing and Applied Mathematics Center.

COMPUTATION OF THE EQUILIBRIUM OF A PLASMA WITH HELICAL SYMMETRY

Neal Friedman Sep. 1970 148 p refs

(Contract AT(30-1)-1480)

(NYO-1480-161) Avail: NTIS

The equilibrium configuration of a plasma confined by a helically symmetric magnetic field under magnetohydrodynamic assumptions was calculated. This entails solving an elliptic partial differential equation on a domain with a free boundary. The problem of solving the partial differential equation was separated from that of computing the location of the free boundary. A rectangle with fixed boundary is introduced as an auxiliary domain and the differential equation is solved there. To calculate the location of the free boundary, two variational problems are considered. One is the minimization of the Dirichlet–Douglas integral for conformal mapping; the other is the minimization of an integral connected with the energy of the free-boundary problem. The method of steepest descent is used to develop an iterative procedure suggested by the problem of minimizing these two functionals. Convergence of this algorithm yields a conformal mapping of the rectangle onto the original domain. Author (NSA)

N71-18526# Stanford Univ., Calif. Inst. for Plasma Research.

LOW FREQUENCY AXISYMMETRIC WAVES IN A WEAKLY IONIZED MAGNETOPLASMA COLUMN

A. J. Duncan and J. R. Forrest Aug. 1970 62 p refs

(Contract AT(04-3)-799)

(SU-IPR-366) Avail: NTIS

A simplified theory is developed for wave propagation in a homogeneous weakly ionized plasma in a uniform magnetic field, taking into account perturbations in the electron temperature and ionization rate. Ionization waves are predicted, and good qualitative and quantitative agreement with experiment is found. With increasing magnetic field or neutral gas pressure, these waves become unstable and grow to the nonlinear limit known as striations. Experimental wave propagation measurements on a helium discharge for pressures in the range 38 to 600 mtorr, and for magnetic fields up to 300 G, are described. The dispersion characteristics of the dominant mode agree well with the predicted plane ionization wave. Author (NSA)

N71-18527# Los Alamos Scientific Lab., N.Mex.

CONFERENCE ON DIAGNOSIS OF HIGH-TEMPERATURE PLASMA

Oct. 1970 157 p Transl. into ENGLISH of the Publ. 'Soveshchenila po Diagnostike Vysokotemperaturnoi Plazmy, Sukhumi, Mai 13–20 1970' USSR Conf. held at Sukhumi, 13–20 May 1970

(LA-4250-TR; CONF-700543) Avail: NTIS

Abstracts are given of 102 papers presented at the conference. The papers are given under the following sections: (1) correlation method of analyzing results of a plasma experiment, (2) probe and

other methods of plasma diagnostics, (3) laser applications (interferometry), (4) corpuscular method, (5) microwave methods, (6) methods of automatic processing of results, (7) laser application (scattering), (8) spectroscopic methods, and (9) ultraviolet and soft X-radiation. NSA

N71-18528# Stanford Univ., Calif. Inst. for Plasma Research.
LAGRANGIAN APPROACH TO NON-LINEAR WAVE INTERACTIONS IN A WARM PLASMA
J. J. Galloway and H. Kim Aug. 1970 36 p refs
(Contract AT(04-3)-799)
(SU-IPR-381) Avail: NTIS

The coupled-mode equations and coupling coefficients for three-wave interaction are derived by a Lagrangian approach for a general medium. A derivation of the Low Lagrangian for a warm plasma is then given that avoids certain problems associated with the original analysis. An application of the Lagrangian method is made to the interaction between collinearly propagating electrostatic waves, and a coupling coefficient is derived that agrees with a previous result obtained by direct expansion of the nonlinear equations. Author (NSA)

N71-18570# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
PROPERTIES OF MARGINALLY-STABLE COLLISIONLESS DRIFT-UNIVERSAL MODES WITH APPLICATION TO THE W-2 STELLARATOR
J. E. McCune and K. U. von Hagenow Apr. 1970 34 p refs
Prepared in cooperation with MIT
(Grant AF-AFOSR-1697-69)
(IPP-6/85) Avail: AEC Depository Libraries

The marginal-stability properties of a class of collisionless drift universal plasma modes are studied numerically and analytically. The familiar slab model of plasma equilibria with gradients perpendicular to B is employed, and both hydrogen and barium plasmas are treated. Specific information is provided that enables one to decide whether or not a given mode is unstable in a given machine; possible application to the Wendelstein (W-2) experiment at low densities is discussed. Analytic formulas for the properties of the marginally stable modes are developed. The marginally stable modes divide roughly into three regimes: small m-number modes with sufficiently long parallel wave lengths first become unstable at relatively low densities and are then stabilized again as the density is increased; large m-number modes, by contrast, possess a critical parallel wave length which decreases monotonically with increasing density. Author (NSA)

N71-18571# RAND Corp., Santa Monica, Calif.
TRANSPORT ANALYSIS OF A THERMIONIC DIODE PLASMA
A. Leonard Nov. 1970 52 p refs
(Contract F44620-67-C-0045)
(AD-715928; RM-6148-PR) Avail: NTIS CSCL 10/2

The transport of electrons and ions in a thermionic converter is analyzed through a pair of Boltzmann equations and an electric field equation. Ionization of cesium neutrals in the gap is accounted for by electron impact with a speed-dependent ionization cross section. Transport of ions is approximately by diffusion theory, neglecting the electric field term that is inversely proportional to the ion mass. After linearizing the electric field term in the electron transport equation, a complete set of solutions to the system of homogeneous equations is determined; these homogeneous solutions form the basis for an expansion of the actual electron, ion, and electric field distributions existing in the converter gap. Finally, very general boundary conditions appropriate to thermionic converter operation are applied to an expansion of the solutions. Author (GRA)

N71-18655# Stanford Univ., Calif. Inst. for Plasma Research.
STUDIES OF PLASMA OSCILLATIONS Status Report, 1 Feb. – 31 Jul. 1970
Aug. 1970 43 p refs
(Contract AT(04-3)-799)
(SU-IPR-389; Rept-36) Avail: NTIS

Continuing research is reported on the following: (1) low-frequency wave propagation and positive column instabilities, (2) electron cyclotron echoes and collision measurements, (3) wave – wave interaction phenomena, and (4) beam – plasma interactions. NSA

N71-18660# Air Force Weapons Lab., Kirtland AFB, N.Mex.
COUPLED ELECTROMAGNETIC AND ELECTRON ACOUSTIC WAVE PROPAGATION IN INHOMOGENEOUS LOSSY PLASMA LAYER Technical Report, Nov. 1969 – Aug. 1970
Hugh L. Southall Sep. 1970 173 p refs
(AD-715910; AFWL-TR-70-110) Avail: NTIS CSCL 20/14

A hydrodynamic treatment is used to derive the coupled wave equations for wave propagation in a compressible plasma. Electron acoustic waves in the plasma are assumed to be excited by a vertically polarized electromagnetic wave obliquely incident upon a plane dielectric-plasma interface. Finite difference numerical solutions for the electromagnetic field and the scalar pressure field are obtained in a reentry-type plasma layer surrounding high-performance hypersonic reentry vehicles. An inhomogeneous plasma layer (or sheath) is modelled with a linearly increasing electron density profile. The coupling of acoustic waves to electromagnetic waves in this inhomogeneous region is investigated. Numerical results are obtained for the conversion of electromagnetic energy to plasma wave energy and vice versa. Author (GRA)

N71-18665# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaire.
BUILDUP OF A PLASMA IN A MAGNETIC WELL WITH A MULTIENERGY AND MULTIANGLE NEUTRAL ATOM INJECTION SYSTEM
R. Dei-cas and F. Hennion 1970 4 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 31 Aug. – 4 Sep. 1970
(CEA-CONF-1604; CONF-700817-12) Avail: AEC Depository Libraries

Numerical calculations of the plasma buildup, anisotropy, and energy distribution are presented for a neutral multi-injection system (10 injectors) in a quadripolar coil. NSA

N71-18696*# Stanford Univ., Calif. Inst. for Plasma Research.
THREE-WAVE INTERACTION IN A BEAM-PLASMA SYSTEM
H. J. Hopman (FOM-Inst. voor Atoom- en Molecuulfysica) Dec. 1970 48 p refs
(Grant NGL-05-020-176)
(NASA-CR-116783; SU-IPR-402) Avail: NTIS CSCL 20I

The coupling coefficient for nonlinear three-wave interaction is derived for the case of a cylindrical plasma column penetrated by an electron beam. The parametric growth rate of two plasma waves is calculated, assuming that a negative energy wave on the beam satisfies appropriate synchronism conditions with them and acts as a pump wave. A beam-plasma experiment is described in which three-wave coupling was observed between two beam waves and a low frequency plasma wave. All three waves grow in space, with a growth rate of the order of one tenth of the wave number of the beam waves. Author

N71-18715*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXTENSION OF FROST'S MIXTURE RULE TO INCLUDE

THE EFFECTS OF MULTIPLE IONIZATION ON ELECTRICAL CONDUCTIVITY: APPLICATION TO EQUILIBRIUM AIR AT 3000 TO 28000 K

John R. Viegas Washington Mar. 1971 30 p refs
(NASA-TN-D-5977; A-3653) Avail: NTIS CSCL 20I

An extension of previously developed expressions for the electrical conductivity of a plasma is presented. This extension includes an accurate accounting for the effects of ionic charge in the Coulombic collision frequency and a correction factor that extends the range of temperatures and pressures. It is applied to the problem of obtaining accurate values for the electrical conductivity of equilibrium air. The temperatures and density ratios (based on standard atmospheric density) range from 3,000 K to 28,000 K and 0.000001 to 100. The results, presented primarily in tabular form, include other useful plasma dynamic parameters for equilibrium air. Comparisons are also made with various other methods of calculating the electrical conductivity of air. Author

N71-18716# Georgia Inst. of Tech., Atlanta.

TESTS OF THE WANNIER EXPRESSIONS FOR DIFFUSION COEFFICIENTS OF GASEOUS IONS IN ELECTRIC FIELDS

E. W. McDaniel and J. T. Moseley Nov. 1970 22 p refs
(Contract N00014-67-A-0226-0005; Proj. Squid)
(AD-715375; SQUID-TR-GIT-8-PU) Avail: NTIS CSCL 7/4

All of the published experimental values of longitudinal and transverse diffusion coefficients of gaseous ions in electric fields, except those cases dominated by resonant charge transfer, are compared with the predictions of Wanniers theory. The products of the measured coefficients and the gas number density appear to vary as v(d)cubed/(E/N), where v(d) is the ionic drift velocity, in agreement with Wanniers predictions. Here E/N is the ratio of the electric drift field intensity to the gas number density. In addition, the absolute agreement between experiment and theory is quite satisfactory. Author (GRA)

N71-18718# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).

NUMERICAL COMPUTATION TO DESIGN A ROTATING FIELD PINCH EXPERIMENT

E. S. Weibel and A. Lietti Jun. 1970 21 p refs Sponsored by the Fonds Natl. Suisse de la Recherche Sci.
(LRP-44/70) Avail: NTIS

The model proposed is a simple one, describing the dynamics of a rotating field pinch in terms of the macroscopic quantities: temperature, pressure, plasma radius and magnetic field strength. The field is obtained by producing oscillating currents in resonant circuits, which are fed by line RF pulse generators. The computation takes into account the equations of the electrical system and of the gas dynamics. The result of this computation is compared with the result of an experiment performed in a 5 × 50 cm discharge tube. The amplitude program which is necessary in order to confine the plasma on a larger scale is established. Author

N71-18719# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.

DEVELOPMENT OF A PLASMATRON ION SOURCE WITH SLIT GEOMETRY FOR AN ELECTROMAGNETIC MASS SEPARATOR [ENTWICKLUNG EINER PLASMATRONION ENQUELLE IN SCHLITIZGEOMETRIE FUER EINEN ELEKTROMAGNETISCHEN MASSENTRENNER]

H. Winter 1970 83 p refs In GERMAN
(SGAE-PH-93/1970) Avail: AEC Depository Libraries

With the help of probe measurements in the internal and external plasma of the ion source, the principal modes of operation of plasmatron ion source were experimentally verified. After an extensive investigation of the methods used for the characterization of the beam quality of intensive ion beams and of the factors causing beam quality deterioration, it was shown that with the help of the concepts of emittance and brilliance only clear assumptions on the effect of the ion source on the separation power obtainable could be made. On the basis of a simple model of ion extraction from the meniscus of the plasmatron ion source, data were given on the possible heights of the ion currents, reported on the basis of the size of the premissible beam aperture angle, the ion mass, and the length of the emission slit. Author (NSA)

N71-18762# Sandia Corp., Albuquerque, N.Mex.

RESEARCH ON STUDYING AND INCREASING THE PLASMA PARAMETERS ON 'NONCYLINDRICAL Z-PINCH' EQUIPMENT

V. I. Agafonov et al 20 Nov. 1970 32 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Moscow, Inst. at. Energii, rep IAE-2017 Sponsored by AEC
(SC-T-70-4046; IAE-2017) Avail: NTIS

Experimental research on plasma focus used with equipmen having an increased energy storage in the capacitor bank is described. The dependence of the plasma focus parameters on the energy stored in the capacitor bank is discussed. The dependence of neutron yield K on energy stored in the bank is on the order of 2.5. As a result of the experiments, a neutron emission intensity of 10 to the 18th power neutrons/sec is obtained, with an absolute yield on the order of 1.1 × 10 to the 11th power n/shot. NSA

N71-18817# Aerospace Corp., El Segundo, Calif. Lab Operations.

VOLUME IONIZATION BY MEANS OF LASER RADIATION IN A CESIUM PLASMA DIODE

Peter E. Oettinger and C. Forbes Dewey, Jr. (MIT) 30 Sep. 1970 42 p refs
(Contract F04701-70-C-0059)
(AD-715883; TR-0059(6220-50)-6; SAMSO-TR-70-397) Avail: NTIS CSCL 20/9

The paper considers the possibility of enhancing neutralization of the interelectrode space charge in a cesium diode by the use of line radiation. Ionization results from a two-step process. The neutral cesium atoms are first raised to an excited electronic level by line radiation (typically from a solid-state laser). The excited neutrals, being within a few kT of the continuum, are then collisionally ionized by plasma electrons. A detailed consideration of the optical excitation cross sections and electron-neutral collision cross sections for the highly excited states suggests that plasma densities of 10 to the 15th power/cc can be produced. The thermal economics of this system appear to be attractive when compared to contact ionization and collisional ionization and collisional ionization as well as previously proposed schemes employing radiation. Author (GRA)

N71-18818# Avco-Everett Research Lab., Everett, Mass.

ELECTROSTATIC ELECTRON OSCILLATIONS IN CYLINDRICAL, NON-NEUTRAL PLASMAS

Lewis M. Linson Sep. 1970 34 p refs
(Contracts F44620-70-C-0067; AT(30-1)-3863)
(AD-715882; AERL-RR-358; NYO-3863-15) Avail: NTIS CSCL 20/9

The character and stability of electrostatic electron waves which propagate both parallel to B (wavenumber beta) and perpendicular to B (azimuthal mode number l) in non-neutral plasmas in cylindrical geometry are studied. The background ions are taken to be infinitely massive and so provide a partial neutralization of the unperturbed electron space charge; this neutralization ranges from the completely unneutralized electron plasma case to the more familiar case of a completely neutral plasma. It is found that the axisymmetric mode (l = 0) is stable for arbitrary radial density variation when the

charge density is not too high. For l > or = 1 and electron and ion densities constant out to r = a and zero beyond, the system is stable for all frequencies independent of the degree of neutralization and the location of a conducting outer wall. The dispersion relation is analogous to that for a neutral plasma permitting separate low and high frequency propagation bands. For low frequencies and low, nonincreasing electron, ion, and net charge densities, it is found that the presence of a resonant layer (zero frequency as seen by the electrons) within the electron cloud is necessary but not sufficient for instability. In general, finite axial wavenumber increases the tendency towards stability. Author (GRA)

N71-18819# Air Force Cambridge Research Labs., Bedford, Mass.
POTENTIAL DUE TO A CIRCULAR DOUBLE DISK
Christopher Sherman and Lee W. Parker (Mount Auburn Research Associates, Inc.) 12 Oct. 1970 20 p refs *Its* Phys. Sci. Research Papers No. 431
(AD-715889; AFCRL-70-0568) Avail: NTIS CSCL 20/3

A solution for the potential due to an inner circular disk at a constant potential surrounded by an annular ring at another constant potential is given. The general solution is expressed both as an elliptic integral and as an expansion in Legendre polonomials. The case in which the two conductors are separated by a thin gap is also considered. An application of the solution to the collecting properties of a plasma probe is discussed. Author (GRA)

N71-18820# Naval Research Lab., Washington, D.C.
A PHYSICALLY MOTIVATED SOLUTION OF THE ALFVEN PROBLEM Final Report
Jay P. Boris Nov. 1970 14 p refs Sponsored by DASA and AEC
(AD-715774; NRL-MR-2167) Avail: NTIS CSCL 20/9

The Alfven problem has plagued explicit numerical calculations of magnetohydrodynamic fluid behavior in regions where the fluid density is relatively small but can be solved by the inclusion of terms representing the displacement current in Maxwells Equations. This modification limits the important physical velocities to c in a realistic way and so permits much longer computational time steps than had previously been possible. Thus the small c technique will greatly extent the usefulness of present day computers for solving these MHD problems. Author (GRA)

N71-18839# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DIFFUSION OF MULTIPOLE MAGNETIC FIELDS THROUGH A CONDUCTIVE WALL OF A PLASMA CONTAINER
Sunao Kawasaki Nov. 1970 20 p refs
(IPPJ-T-3) Avail: NTIS

Diffusion of multipole magnetic fields (specially quadrupole) into a plasma container through its conductive cylindrical wall with a finite thickness is studied with regard to the design of the system of the stabilizing field in BSG experiment. The lower limit of the diffusion time is estimated by solving the Maxwell equation with the special initial and boundary conditions, and evaluating the rate of evolution of the time dependent solutions. It is found that the rate does not depend on the harmonic number of Fourier component of the initial field distribution. The theory is consistent with the experimental result. Author

N71-19246 Rensselaer Polytechnic Inst., Troy, N.Y.
ION WAVES IN A HIGHLY IONIZED INHOMOGENEOUS HOLLOW CATHODE GAS FED ARC PLASMA IN A MAGNETIC FIELD
Heinz Alfred Schmidt (Ph.D. Thesis) 1969 280 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.60 Order No. 70-2645

Plasma body rotation and self-excited low frequency oscillations were studied in a highly ionized low pressure hollow cathode gas-fed arc device. Argon gas was used with a gas flow rate of 0.07 to 0.7 atm cu cm/sec corresponding to a background pressure range from 0.0001 to 0.001 torr, and the electron density and electron and ion temperatures were of the order of 10 to the 13th power/cu cm, 5 eV and 0.5 eV. The longitudinal magnetic field range covered was from 200 to 2000 gauss. The observed low frequency waves were identified as ion acoustic and resistive drift instabilities by studying their dependences on neutral gas pressure, magnetic field, arc current, arc length and ion mass. Dispersion relations for linearized radially localized waves, which include the effect of charged particle-neutral atom collisions, are derived. It was found that the ion acoustic and drift wave frequencies both decreased with increasing gas pressure, but increased with increasing magnetic field. No dependence on the magnitude of the arc current could be found. Dissert. Abstr.

N71-19247 New York Univ., N.Y.
HYPERLIPTIC MAGNETOHYDRODYNAMIC STEADY FLOW PAST A POINT SOURCE
Stanley Friedlander (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-3064

The disturbance field generated by a point source is obtained for steady, three-dimensional, isentropic, magnetohydrodynamic flow. The flow is governed by the Lundquist equations linearized about constant velocity, matter density, and magnetic field. The flow is assumed to be hyperliptic, i.e., the negative of the free stream velocity lies within the fast wave front of the time-dependent characteristic surface but outside the two cusped slow wave fronts of this surface. There are both real and complex characteristics. New dependent variables are introduced which separate the flow into transverse and compressive components. The transverse component is propagated one-dimensionally with the Alfven velocity. The determination of the compressive component is reduced to finding the fundamental solution of a fourth order homogeneous differential equation with constant coefficients. The solution is required to satisfy smoothness and causality conditions and a condition on the growth at infinity. Dissert. Abstr.

N71-19248 New York Univ., N.Y.
COMPRESSION OF AN AXIALLY SYMMETRIC PLASMA WITH NON-ISOTROPIC PRESSURE
Barry Michael Marder (Ph.D. Thesis) 1969 104 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 70-3087

A two-fluid collisionless model of a plasma is used to describe the behavior of a fully ionized gas under axially symmetric radial compression. Two pressure tensors are derived and used in the equations, one for the ions and one for the electrons. The ion pressure is determined by taking higher moments of the ion Vlasov equation and assuming that the third moments of the distribution function can be neglected. Expressions for the electron pressure are found from an asymptotic expansion of the electron distribution function. The expansion parameter is the square root of the ratio of the electron mass to the ion mass. The electron pressure tensor is found to depend on the magnetic fields as well as the density while the ion tensor is approximately proportional to the density raised to a power which depends on the radius. Dissert. Abstr.

N71-19249 Howard Univ., Washington, D.C.
GREEN'S FUNCTION THEORY OF FIELD CORRELATIONS IN PLASMAS
Michael Jerome Smith (Ph.D. Thesis) 1969 90 p

Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 70-2007

Modern theoretical techniques based on the application of Green's function methods are applied to the calculation of longitudinal and transverse dielectric functions in a neutral, isotropic, equilibrium plasma. These dielectric functions are used to calculate the electric field-field correlation function. In the plasma model used, the ions form a smeared positive background in which the electron gas is imbedded. For such a plasma, two classical Green's functions, which are solutions of Maxwell's equations in the Coulomb gauge, are related to the longitudinal and transverse dielectric functions respectively. These dielectric functions describe the system's response to external stimuli. Two quantum mechanical solutions are also obtained. To first order, these are found to be double-time, temperature dependent, retarded Green's functions. Dissert. Abstr.

N71-19283# California Univ., Livermore. Lawrence Radiation Lab.

ULTRA HIGH VACUUM TECHNIQUES FOR CONTROLLED FUSION RESEARCH

T. H. Batzer 23 Mar. 1970 6 p refs Presented at the 5th Ann. Intersoc. Energy Conversion Eng. Conf., Las Vegas, Nev., 21–25 Sep. 1970 Sponsored by AEC

(UCRL-72317; CONF-700912-7) Avail: NTIS

Plasmas of interest in controlled fusion research have temperatures and particle densities greater than 10 to the 7th power K and 10 to the 10th power particles/cu cm, requiring containment in vacuum by magnetic fields. Without regard to the containment stability of the magnetic field geometry, the principal plasma loss mechanism is charge exchange with the residual gas or vacuum in which it is immersed. The density and composition of the contaminating residual gas are associated with the base-pressure limitations of available vacuum systems, desorption from the vacuum wall, and cold gas streaming in from plasma sources, such as plasma guns or high-energy (>1 keV) neutral beam tubes. The vacuum techniques developed to approach 10 to the −10th power torr, such as all metal, bakeable vacuum systems, high-speed surface pumps, and devices to reduce beam-tube gas streaming, are discussed. Author (NSA)

N71-19284# Gulf General Atomic, San Diego, Calif.

CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Summary Progress Report, 1 Aug. 1969 – 31 Jul. 1970

T. Ohkawa 15 Sep. 1970 84 p refs

(Contract AT(04-3)-167)

(GA-10278) Avail: NTIS

The program consists of experiments with two devices, the dc octopole and the Doublet-2 and the supporting theoretical efforts. The dc octopole was completed previously and has demonstrated good plasma confinement. A containment time of 500 Bohm times has been observed in the collisionless regime. In the collisional regime the plasma behavior may be explained by classical theory. Except for a small discrepancy of a numerical factor, the plasma loss has the characteristics of resistive diffusion. The dc octopole is used as a test bed for studying the plasma in toroidal geometry. The effects of field errors, background gases, properties of plasma convection cells, heating of plasma, propagation properties of waves, and trapped particle instabilities are discussed. The construction of the Doublet-2 device is in progress. NSA

N71-19286# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.

EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF TURBULENT PLASMA HEATING Final Report, Apr. 1968 – Sep. 1969

M. O. Hagler and D. B. Lancaster 1 Nov. 1969 48 p refs

(Grant NSF GK-3196)

Avail: Issuing Activity

In the experiment considered, a particular mode of the plasma selectively drives it into turbulence. The wave associated with the mode is a quasi-static in cyclotron wave. In order to launch the quasi-static ion cyclotron waves, deuterium gas is first pre-ionized by an RF pulse and then exposed to an encircling magnetic field which ionizes the gas completely. With the plasma formed and a constant magnetic field applied axially, a generator applies a potential between electrodes within the plasma tube at a harmonic of the ion cyclotron frequency. The resulting electric field is intended to be of sufficient amplitude to overcome the linear barrier in order to obtain a turbulent plasma. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-18158# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

SUPERCONDUCTING COIL STABILITY AND INTERACTION BETWEEN THE TRANSPORT CURRENT AND DIAMAGNETIC CURRENTS

A. P. Martinelli Apr. 1970 37 p refs

(IPP-4/76) Avail: AEC Depository Libraries

Stability tests were made on superconducting samples (Nb–25% Zr, Nb–48% Ti, stabilized and nonstabilized) of single-layer coils in which a critical state was reached by applying transport current I and transverse field H in the procedures (I–H), (H–I), and H and I simultaneously (coil simulation). By using the coil simulation procedure, and also pulsed fields, indirect experimental evidence is given of minimum stability of the parts of the coil winding located in the 15 to 20 kOe region. The test results are related to results of similar tests reported in the literature. Particular attention is devoted to the interaction between the transport current and diamagnetic currents and to its effect on stability. The results suggest an additional general approach to the known methods of stabilizing coils by scaling the superconductor cross section to the transverse field. This approach should make it possible, by reducing the diamagnetic currents in the superconductor, to attain better field homogeneity and improve material utilization and coil stability. Author (NSA)

N71-18167# Thermo Electron Corp., Waltham, Mass.

SUBLIMED EMITTER AND COLLECTOR COATINGS

D. Ernst, R. Meyers, and V. Poirier Jun. 1970 64 p refs

(Contract AT(30-1)-4125)

(TEE-4125-2; TE-4122-2-71) Avail: NTIS

Initial work on coating of planar W emitters with additional layers of W involved deposition in such a way that the surface of the added layer was a better cesiated emitter than the original substrate. It was found that the vacuum work function of polycrystalline W(4.5 to 4.6 eV) could be increased to the level of single-crystal (110) W (5.1 to 5.2 eV) Results of studies have indicated that, under certain depositing conditions, the bounding planes on the new surface are predominantly (110), no matter what the orientation of the underlying substrate; evidence suggests that it is this phenomenon that results in the improvement in work function. One such coated W emitter was tested in a cesiated diode; its performance is described. Related work was also done with niobium collectors, coating them with sublimed deposits of Mo, Ni, Nb, and W. Thermal cycling, metallography, X-ray diffraction, and surface contour studies were used to characterize these collector coatings. Diode performance studies are under way. Author (NSA)

N71-18379# Battelle Memorial Inst., Columbus, Ohio.
STUDY OF PROCESS FOR FORMING HETEROJUNCTIONS BY GOLD-SOLVENT ALLOYING Final Report, 1 Mar.–1 Aug. 1970
Yuan-Feng Chang 8 Oct. 1970 18 p refs
(Contract F19628-70-C-0163)
(AD-715307; AFCRL-70-0567) Avail: NTIS CSCL 20/12

In the investigation of the gold-solvent alloying technique for the fabrication of heterojunctions, the criteria for obtaining good-quality Ge-GaAs heterojunctions with planar interfaces and single-crystal regrowths were determined. The alloying mixture of gold and germanium must be of homogeneous composition. The time rate of temperature rise during melting and of temperature fall during crystal growth must be very low. In addition, the temperature gradient across the solid-liquid interface must be carefully controlled during both the melting and crystal-growing periods.
Author (GRA)

N71-18380# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
LATTICE THEORY OF FACE-SHEAR AND THICKNESS-TWIST WAVES IN BODY-CENTERED CUBIC CRYSTAL PLATES
Chung Gong Oct. 1970 85 p refs
(Contract Nonr-4259(13))
(AD-715664; TR-16) Avail: NTIS CSCL 20/12

An analytical study is made of face-shear and thickness-twist waves propagating along the (100) and (110) directions of a body-centered cubic lattice plate bounded by a pair of (001) surfaces. The behavior of the waves in the (110) direction is similar to that found previously for analogous waves in the (100) direction of simple-cubic and face-centered cubic plates. In the (100) direction of the body-centered cubic plate, the situation is quite different. Near the halfway point of the first Brillouin zone, the lowest symmetric mode and the lowest antisymmetric mode are predominantly surface modes and the remaining modes group together in a narrow, high frequency band-pass. The results of numerical computations are exhibited for iron and tungsten.
Author (GRA)

N71-18411# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
MASS TRANSPORT AND ATOMIC STRUCTURE NEAR METAL SURFACES Final Report
John M. Blakely Oct. 1970 9 p
(Grant AF-AFOSR-1433-68)
(AD-715291; AFOSR-70-2528TR) Avail: NTIS CSCL 7/4

The program of research was concerned with the study of the structure of perfect surfaces and defect distribution near surfaces. The study of perfect surfaces is a necessary preliminary to the investigation of more complicated systems involving for example adsorption from the gas phase. For this part of the work, the method of low energy electron diffraction was used as the principal experimental technique. Defects near ionic crystal surfaces have been studied by measurements of surface potential on single crystals of various orientations. The process of surface diffusion which involves mobile defects has been studied by a mass transport method developed during the course of this investigation.
Author (GRA)

N71-18412# Illinois Univ., Urbana.
THEORY OF SOLIDS AND CONDENSED MATTER Final Report, 1 Oct. 1966–31 Aug. 1970
John Bardeen Nov. 1970 7 p refs
(Grant AF-AFOSR-0328-67)
(AD-715294; AFOSR-70-2616TR) Avail: NTIS CSCL 20/12

Particular attention was devoted to the role of particle interaction in determining the properties of solids and condensed matter. The problems under investigation ranged from study of the combined influence of electron-electron and electron-ion interaction on the transport and static properties of metals to consideration of sound propagation in quantum liquids such as He3 and He4. They included the study of transport phenomena in Fermi liquids such as electrons in nearly ferromagnetic metals or liquid He3.
Author (GRA)

N71-18413# California Univ., Berkeley. Lawrence Radiation Lab.
VAPORIZATION MECHANISM OF GALLIUM ARSENIDE SINGLE CRYSTALS
Catherine Yuen-Chien Lou (Ph.D. Thesis) Sep. 1970 104 p refs
(Contract W-7405-eng-48)
(UCRL-19685) Avail: NTIS

The kinetics of vaporization of gallium arsenide single crystals into vacuum were investigated using microbalance and mass spectrometric techniques in the temperature range 700 to 900 C. It was found that gallium arsenide vaporized incongruently to give liquid gallium and arsenic vapor molecules. The total evaporation rates and the activation energies were found to be the same for both faces. The initial vacuum vaporization rate of gallium arsenide single crystals is lower than the maximum rate calculated from equilibrium vapor pressures by about a factor of two but the activation energy is the same (90 kcal/mole) as the heat of sublimation (per mole of GaAs). When excess gallium liquid was placed on top of the vaporizing surface, the rate was found to be increased by a factor of two compared to the calculated maximum rate, while the activation energy remained unchanged.
Author (NSA)

N71-18420# Massachusetts Inst. of Tech., Cambridge.
GROWTH AND EVALUATION OF SINGLE CRYSTAL BISMUTH AND RELATED COMPOUNDS Final Report, 15 Mar. 1968–14 Mar. 1970
David J. Epstein Wright-Patterson AFB, Ohio AFAL Aug. 1970 95 p refs
(Contract F33615-68-C-1490)
(AD-715312; AFAL-TR-70-172) Avail: NTIS CSCL 20/2

Attempts were made to grow thick single crystals of bismuth titanate by the top seeded solution method. Unfortunately, the authors were unable to overcome the tendency of bismuth titanate to grow in platey form. There is some indication that germanium oxide, and perhaps molybdenum oxide, added to the melt as a flux promotes denser growth. Large, optically clear crystals of gadolinium molybdate were grown by the RF-Czochralski method. Large single crystals of gadolinium molybdate were also grown by the top seeded solution method; these had lower strain than the RF-Czochralski grown crystals but showed a slight cloudiness. Ultrasonic pulse-echo measurements at 10 MHz have been used to measure the temperature dependence of the diagonal elements of the elastic constant tensor of gadolinium molybdate, Gd2(MoO4)3, in the neighborhood of the ferroelectric phase transformation at 159C. Mixed crystals in the KTa(x)Nb(1-x)O3 systems have been grown with compositions ranging from KTaO3 to 60% KNbO3. The polarization dependence of the small signal dielectric constant was measured using a low duty factor ac bias technique. Raman scattering was observed in crystals with compositions between 6% and 33% KNbO3. The ferroelectric soft mode was overdamped in the tetragonal and orthorhombic phases of all crystals observed.
Author (GRA)

N71-18506# Toulouse Univ. (France)
EFFECTS OF VERY HIGH ENERGY PROTONS ON ELECTRIC PROPERTIES OF SILICON AND GERMANIUM [EFFETS DES PROTONS DE GRANDE ENERGIE SUR LES PROPRIETES ELECTRIQUES DU SILICIUM ET DU GERMANIUM]
Danielle Bialla-Daspet (Ph.D. Thesis) 2 Mar. 1970 244 p refs
In FRENCH

(NP-18474) Avail: AEC Depository Libraries

The effects of high-energy protons (270, 590, and 3000 MeV) on the density, mobility, and lifetimes of carriers, in samples of n- and p-silicon and germanium, were studied at different temperatures. The degradations observed were between 50 and 100 times greater than those produced by irradiation with 4.5-MeV electrons. The existence of a particular type of perturbed zone, produced by the protons, was proved; this zone is defined by a very large region and a relatively low density of displaced atoms. This defect is introduced simultaneously with the dense clusters in the germanium and is the only phenomenon dominating the observed degradation for the case of silicon. Its diffuse character is particularly accentuated in silicon. Two kinds of defects occur simultaneously within this defect: point and cluster types. Author (NSA)

N71-18636# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.

STUDY OF THE INTERACTION BETWEEN MAGNETIC FLUXOIDS AND CRYSTAL DEFECTS IN TYPE 2 SUPERCONDUCTORS Informal Progress Report

Edward J. Kramer 31 Oct. 1970 27 p refs

(Contract AT(30-1)-4060)

(NYO-4060-5) Avail: NTIS

Progress is reported for investigations into: (1) determining the fluxoid dislocation interaction from stress relaxation experiments, (2) characterizing experimentally the surface pinning in niobium single crystals with respect to surface roughness, and (3) defining the conditions under which fluxoid lattice dislocation motion controls the voltage observed across the superconductor. Details are presented for stress relaxation measurements, surface pinning characteristics, and dislocation motion in the fluxoid lattice. E.C.

N71-18637# Case Western Reserve Univ., Cleveland, Ohio.

SOLID STATE PHYSICS PROGRAM Annual Progress Report

Nov. 1970 36 p refs

(Contract AT(11-1)-623)

(COO-623-156) Avail: NTIS

Investigations in thin film physics, cohesive properties of crystals, and solid state theory are reviewed. Thin film physics tasks include: torque magnetometer measurements, Moessbauer measurements, stress in platinum films, stress anisotropy, magnetic measurements, and liquid crystal thermography. Cohesive properties work includes: pressure and temperature derivatives of the elastic constants of SrF2, elastic constants and pressure derivatives of CdF2, dielectric constants of alkaline earth fluorides, elastic constants of semiconductors, elastic properties of lead, elastic constants of sodium and Cu-Ni alloys, dielectric constants of LiF, NaF, NaCl, NaBr, KCl, and KBr. Solid state studies are on: properties of disordered systems, virtual recoil effects in metals and alloys, electron-ion interactions in glass, Block electrons in magnetic fields, the Knight shift, and the magnetoresistance and size theory in metals. E.C.

N71-18676# Army Electronics Command, Fort Monmouth, N.J.

HOT CARRIER MOBILITY EFFECTS IN MAGNETO-SCHOTTKY JUNCTIONS

H. Mette, E. Ahlstrom, and D. Yarbrough Nov. 1970 20 p refs

(AD-715706; ECOM-3357) Avail: NTIS CSCL 20/12

The report describes a theoretical investigation of the influence of hot carrier mobilities on magnetoelectric effects in forward-biased Schottky junctions. Average energies of carriers injected over the barrier have been calculated from simple band theory for the first time and are used to plot the dependence of the average injected mobilities on forward voltage and barrier heights. The results indicate that hot electron mobility effects make a significant contribution to magnetoelectric effects and must be taken into consideration for a comprehensive theory of such phenomena. Author (GRA)

N71-18677# Army Materials and Mechanics Research Center, Watertown, Mass.

THE EFFECT OF SYSTEMATIC ERRORS ON THE MEASUREMENT OF LATTICE CONSTANTS

Charles P. Gazzara Sep. 1970 11 p refs

(AD-715354; AMMRC-TR-70-29) Avail: NTIS CSCL 20/2

An analysis was performed on the systematic error functions involved in a determination of the lattice parameters of powder materials using Bragg angles from a standard X-ray diffractometer. Combinations of the pertinent systematic error functions were used to maximize the accuracy of the lattice parameters calculated with a least-squares computer program. Author (GRA)

N71-18678# Wyoming Univ., Laramie.

A STUDY OF ELECTRONIC STATES AND TRANSPORT IN HIGHLY DOPED SEMICONDUCTORS Summary Technical Report, 1 Jun. – 30 Nov. 1970

Shinzo Nakai and John H. Morrison Dec. 1970 43 p refs

(Contract N00014-67-A-0266-0001)

(AD-715392) Avail: NTIS CSCL 20/12

Impurity conduction in doped semiconductors is discussed using the Greens function for high impurity concentration at temperatures near zero. A stochastic method has also been used to investigate the electronic states in an aperiodic system. It is the object of this research to develop a method to carry out a systematic study of electronic structure and conduction mechanism in random lattices. Author (GRA)

N71-18679# Texas Christian Univ., Fort Worth. Dept. of Physics.

MAGNETO-OPTICAL STUDIES OF MAGNETIC FIELD DEPENDENCE OF SPIN-LATTICE RELAXATION Final Report 1 Jun. 1968 – 31 May 1970

Richard J. Lysiak 28 Oct. 1970 172 p refs

(Contract N00014-68-C-0390)

(AD-715448) Avail: NTIS CSCL 20/12

A magneto-optical technique was developed to measure the spin-lattice relaxation time of paramagnetic ions in a crystal lattice as a function of applied static magnetic field strength. This method utilized the Faraday effect at low temperatures. An ac magnetic field modulated the Faraday rotation of plane polarized light traversing the sample. The phase angle between the diamagnetic rotation and the total rotation was measured as a function of frequency of the modulating magnetic field. When the frequency of modulating field exceeded the inverse spin-lattice relaxation time, the modulation of the light due to paramagnetic contributions was diminished leaving only the modulation due to diamagnetic contributions. From these measurements the spin-lattice relaxation time was determined. Second order effects were also considered for the case where tau was assumed to have a time-varying component. Author (GRA)

N71-18682# ARO, Inc., Arnold Air Force Station, Tenn.

INFRARED REFLECTANCE OF WATER FROSTS CONDENSED ON LIQUID-NITROGEN-COOLED SURFACE IN VACUUM Final Report, Jul. 1968 – Sep. 1969

B. E. Wood, A. M. Smith, B. A. Seiber, and J. A. Roux Arnold Eng. Develop. Center Dec. 1970 45 p refs

(Contract F40600-71-C-0002)

(AD-715915; AEDC-TR-70-215) Avail: NTIS CSCL 20/12

Spectral absolute reflectance measurements from 0.5 to 12.0 micrometers were made for water cryodeposits formed on liquid-nitrogen-cooled surfaces in a vacuum infrared integrating sphere. The results are presented as functions of view angle, deposit thickness, and wavelength. The deposits were formed at pressures between .02 and .04 torr on cryogenically cooled black epoxy paint and polished stainless steel surfaces. All three forms of Ice I were observed - hexagonal, cubic, and amorphous or vitreous - and

depended on the cryosurface temperature. The temperature of the deposit was found to play a strong role in determining the reflectance of any water deposit. From the results obtained in this investigation, important conclusions are drawn with regard to effects on space simulation and component studies in ground test facilities. Author (GRA)

N71-18683# Georgetown Univ., Washington, D.C. Dept. of Physics.
CRITICAL ANGLE REFLECTIVITY OF ULTRASOUND FROM CRYSTALLINE SOLIDS
Orest I. Diachok and Walter G. Mayer Nov. 1970 84 p refs
(Contract Nonr-5037(01))
(AD-715653; TR-5) Avail: NTIS CSCL 20/1

Light-sound interaction techniques were developed for measuring the velocity of ultrasonic surface waves on single crystal copper. The technique provides a quick and relatively simple way of orienting single crystal samples to within plus or minus 1 degree. Single crystal surface wave attenuation data were related to the magnitude of reflection loss as a function of crystal orientation. Ultrasonic scattering measurements were related to reflectivity data from single crystal and polycrystalline solids. Author (GRA)

N71-18684# Stanford Univ., Calif. Electronics Lab.
ELECTRONIC STRUCTURE OF AMORPHOUS AND CRYSTALLINE GERMANIUM: PHOTOEMISSION AND OPTICAL STUDIES
Terence M. Donovan Jul. 1970 157 p refs
(Contracts DAAK02-69-C-0237; DA-31-124-ARO(D)-430)
(AD-715742; SU-SEL-70-047; AROD-5890.8-P; TR-5221-2)
Avail: NTIS CSCL 20/12

Photoemission has been measured in the 1.8 - 11.8 eV spectral range for cleaved single crystal Ge and amorphous Ge films. Cesium was used to lower the photoelectric threshold and extend the measurements for photon energies less than 5 eV for both phases. Similar measurements were made in the 5 - 11.8 eV spectral range on films grown at room temperature (i.e., amorphous films) and then annealed at temperatures below and above the amorphous-crystalline transition temperature. The optical properties for amorphous films have been determined in the 0.1 - 25.0 eV spectral range from a Kramers-Kronig analysis of reflectance data and in the infrared and absorption edge region for films grown on substrates held at temperatures just below the amorphous-crystalline transition temperature. Author (GRA)

N71-18689# Northeastern Univ., Boston, Mass. Dept. of Physics.
EFFECTS OF PHONONS AND IMPURITIES ON SINGLE PARTICLE MODE SCATTERING IN CHROMIUM
J. B. Sokoloff Nov. 1970 9 p refs
(NUB-2040) Avail: NTIS

It is argued that at low temperatures the electron - phonon interaction does not cause significant broadening of the single particle mode peak in the inelastic neutron scattering cross section in chromium at the gap energy. The addition of vanadium impurities is suggested as a means of lowering the gap energy in order to make it easier to perform the experiment to observe this peak in the scattering and thus measure the gap energy by neutron diffraction. Estimates are given of the scattering cross section. Author

N71-18690# Northeastern Univ., Boston, Mass. Dept. of Physics.
QUANTUM MOBILITY, CONFIGURATIONAL ENTROPY, AND MOESSBAUER SPECTROSCOPY OF IMPURITY ATOMS IN CRYSTALS
Allen Widom Jan. 1971 6 p refs
(NUB-2049) Avail: NTIS

The third law loss of configurational entropy in impure cyrstals was attributed to the quantum mobility of the impurity atoms which persists down to absolute zero temperature. Thermal evidence of quantum mobility in crystals has not yet been observed, presumably due to the extremely small mobility band widths. It is shown that Moessbauer spectroscopy can be used to measure mobility band widths with a minimum of cryogenic difficulty. Author

N71-18691# Northeastern Univ., Boston, Mass. Dept. of Physics.
THE LOW TEMPERATURE BEHAVIOR OF THE MULTI-ORBITAL ANDERSON MODEL OF MAGNETIC IMPURITIES
Lowell Dworin Dec. 1970 43 p refs
(NUB-2043) Avail: Issuing Activity

The behavior of a degenerate Anderson Model of localized magnetic moments is obtained by use of a method similar to Migdal's treatment of the critical behavior of the Bose liquid, which was used earlier to discuss the nondegenerate case. It is shown how crystal field effects play a role in the determination of the orbital paramagnetism. The Curie-law transverse susceptibility is obtained exactly in the ideal case Delta = 0 by standard many-body perturbation theory. The alloy systems CuFe and AuV are considered in detail. All of the known properties of these systems (in the limit of infinite dilution) are obtained from a knowledge of the resistivity and T sub K and are in very good agreement with experiment. Author

N71-18765# Louisiana State Univ., Baton Rouge. Dept. of Physics and Astronomy.
CONDUCTIVITY TENSORS IN METALS AND SEMICONDUCTORS Progress Report, 15 Oct. 1969 - 15 Oct. 1970
J. M. Reynolds 1970 14 p refs
(Contract AT(40-1)-3087)
(ORO-3087-44; PR-8) Avail: NTIS

Research on transport phenomena in metals and semiconductors is summarized. Electron - phonon scattering, Fermi surfaces, Knight shifts, and carrier effective masses were among the things studied. A bibliography of eleven papers is included. NSA

N71-18809# Naval Research Lab., Washington, D.C.
AGING OF BARIUM TITANATE AND LEAD ZIRCONATE TITANATE FERROELECTRIC CERAMICS
Jules De Launay and Paul L. Smith 15 Oct. 1970 31 p refs
(AD-715624; NRL-7172) Avail: NTIS CSCL 20/12

The report reviews the present knowledge of the aging process in barium titanate and lead zirconate-titanate ferroelectric ceramics. By aging is meant the passive change in the mechanical and electrical properties of a ferroelectric with time. Experimental data show that these constants vary linearly with the logarithm of time. The Smith, Street and Woolley, and Plessner theories for this logarithmic dependence are revised to remove some of the obscurity in the usual derivation. The experimental evidence of Ikegami and Ueda and of Bradt and Ansell, which is described in some detail, supports the hypothesis that aging is associated with the relief of internal stress through the formation of 90 deg-domains. Author (GRA)

N71-18821# Air Force Cambridge Research Labs., Bedford, Mass.
DAMAGE AND RECOVERY IN ELECTRON IRRADIATED SILICON HEAVILY DOPED WITH PHOSPHORUS
C. P. Carnes, H. M. DeAngelis, R. E. Penczer, and P. J. Drevinsky 3 Aug. 1970 37 p refs /ts Phys. Sci. Research Papers No. 424
(AD-715888; AFCRL-70-0423) Avail: NTIS CSCL 20/12

The damaging effects of radiation on solid state devices are ultimately traceable to radiation-induced changes in material properties vital to the performance characteristics of the device. The identification of defect structures, and an understanding of how they are introduced, altered and removed, and an understanding of the changes in physical properties caused by these defects are important in assessing the effects produced in devices and in evolving corrective measures. The work reported here deals with the introduction and recovery of damage produced in 0.1 ohm-cm P-doped float-zone silicon irradiated at room temperature with 1.0-MeV electrons. Possible explanations are considered for the reduction of the damage introduction rate with repeated electron irradiations and the annealing behavior is compared to that observed in more lightly doped material. The authors suggest that the decrease in introduction rate may be due to recombinations of mobile vacancies with trapped interstitials and/or to recombinations of mobile interstitials with vacancies at defect structures. Isothermal annealing experiments were performed to determine the kinetics of the recovery processes. The recovery kinetics were not resolved, but the recovery processes in silicon heavily doped with phosphorus appear to be more complicated than those involved in more lightly doped material. Author (GRA)

N71-18822# Stanford Univ., Calif. Electronics Lab.
PHOTOEMISSION AND OPTICAL STUDIES OF SrTiO3, TiO2, AND VO2
G. F. Derbenwick Aug. 1970 221 p refs
(Contract DA-31-124-ARO(D)-430)
(AD-715736; SU-SEL-70-070; AROD-5890.9-P; TR-5220-2) Avail: NTIS CSCL 20/12

Photoemission and optical studies are used to probe the electronic structures of SrTiO3, TiO2, and VO2. Measurements of photoelectric quantum yield and photoelectron energy distribution curves have been made using photon energies up to 11.8 and 23.1 eV, respectively. Normal incidence reflectivity of VO2 has been measured up to 11.8 eV and the optical constants have been determined using a Kramers-Kronig analysis. Author (GRA)

N71-18823# Systems Research Labs., Inc., Dayton, Ohio.
THERMOLUMINESCENCE OF THORIUM OXIDE SINGLE CRYSTALS Interim Technical Report, Jul. 1968 – May 1970
Elward T. Rodine Wright-Patterson AFB, Ohio ARL Aug. 1970 130 p refs
(Contract F33615-69-C-1017)
(AD-715885; ARL-70-0138) Avail: NTIS CSCL 20/12

The report contains the results of measurements of the thermoluminescence between liquid nitrogen temperature and 300C of a large number of ThO2 single crystals. These results indicate that the same traps occur commonly in crystals grown by different methods and which differ considerably in purity, although there are substantial differences in apparent trapping densities. The most important glow peaks have maxima at about -160C, -120 to -100C, -14C and 150C. The maxima of the thermoluminescence excitation spectra and the ultraviolet cutoff are shown to coincide, indicating that some trap excitation involves a band gap transition and that the band gap is 5.75 eV. The thermoluminescence emission spectra observed in this investigation are quite broad in some cases but in other cases they are the sharp line spectra of particular rare earths. The fluorescence emission for some of these ThO2 crystals appears to be identical to the thermoluminescent emission. Dosage studies on these crystals indicate relative trap densities and show cases of linear and quadratic growth of thermoluminescence with dose. There are strong indications that the trapping states are due to intrinsic defects involving oxygen vacancies, and several models are proposed and correlated with the experimental results. Author (GRA)

N71-18848# National Research Council of Canada, Ottawa (Ontario).
PHOSPHORESCENCE AND DELAYED FLUORESCENCE OF NAPHTHALENE IN VARIOUS MIXED CRYSTALS [PHOSPHORESZENZ UND VERZOEGERTE FLUORESZENZ VON NAPHTHALIN IN VERSCHIEDENEN MISCHKRISTALLEN]
H. Port et al 1970 26 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), no. 23a, 1968 p 315–329
(NRC-TT-1436) Avail: NTIS

Measurements of the phosphorescence and delayed fluorescence emission at temperatures between 1.6 and 50 K are reported for the following mixed crystal system: naphthalene-h8 in naphthalene-d8 and durene; thionaphthene, durene, and beta-methyl naphthalene in naphthene-h8. The emitting species is either the guest molecule or the vicinity of the guest molecule. By an analysis of the temperature dependence of the intensities of delayed fluorescence and phosphorescence it can be shown that the delayed fluorescence is at least mostly due to a thermally activated triplet-triplet annihilation. Triplet energy is transferred from a trap to the annihilation partner by using the exciton band of the host. Spectroscopic and thermal energy gaps between trap levels and the host exciton band are measured. Lifetime measurements in these crystals are reported. Author

N71-18862# Pennsylvania State Univ., University Park. Materials Research Lab.
STRAINS INDUCED AT CERAMIC BICRYSTAL GRAIN BOUNDARIES
Richard A. Queeney, Herbert A. McKinstry, William Campbell, and James Gagorik 30 Nov. 1970 19 p refs
(Contract N00014-67-A-0385-0004)
(AD-715447; TR-2) Avail: NTIS CSCL 20/12

The application of finite element analysis to the problem of a boundary between two different materials has shown a non-uniform distribution of strain near the boundary. A method for measuring the strain in a guage length of micrometers is being developed using an x-ray diffractometer modeled after the technique proposed by W. L. Bond. Author (GRA)

N71-19031*# Stanford Univ., Calif.
EFFECT OF ENVIRONMENT IN FATIGUE OF COPPER CRYSTALS Final Technical Report
Irwin Greenfield Feb. 1971 59 p refs
(Grant NGR-05-020-386)
(NASA-CR-116859; SU-DMS-71-T-15) Avail: NTIS CSCL 20B

The material chosen was copper because of the large amount of quantitative information available about this face-centered-cubic metal. In order to change the surface characteristics, gold was diffused a short distance into the surface; environmental changes were accomplished by conducting the fatigue tests in vacuum (10 to the minus 7th power) or in oxygen (50 torr). The fatigue machine was specifically developed for these tests and was a constant total strain amplitude device. Since a reverse bend fatigue test on single crystals of about 1.0 mm thick was employed, the cycling device produced oscillating loads of less than 500 grams. A measuring system was developed to record the load applied and the strain amplitude during the fatiguing of the specimen. Author

N71-19032# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM. LOW FREQUENCY DIELECTRIC CONSTANTS OF LiF, NaF, NaCl, NaBr, KCl, KBr BY THE METHOD OF SUBSTITUTION
Carl Andeen, John Fontanella, and Donald Schuele Oct. 1970 28 p refs

(Contract AT(11-1)-623)
(COO-623-153; TR-66) Avail: NTIS

The 1000 Hz 300 K dielectric constants of some alkali halides were measured to an accuracy of 0.01% by the method of substitution. Reproducibly different values for various crystals of the same type were obtained which varied beyond the experimental error. The ranges of results for various crystals of each type measured are: LiF, 9.0355-9.0360; NaF, 5.0719-5.0722; NaCl, 5.8940-5.8956; NaBr, 6.3957-6.3974; KCl, 4.8112-4.8182; and KBr, 4.8735-4.8762. The spread for each type of crystal is thought to be attributable to random trace impurities. The numbers are discussed in the light of past values. Author

N71-19033# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
SOLID STATE PHYSICS. STRUCTURE AND INTRINSIC STRESS OF PLATINUM THIN FILMS
Robert F. Rottmayer Jun. 1970 82 p refs
(Contract AT(11-1)-623)
(COO-623-151; TR-64) Avail: NTIS

A detailed analysis of the cantilevered beam technique for measuring stress in thin films has been performed. The limits of applicability of the derived equations have been defined with respect to large deflections, shear distributions at the edge of the substrate and boundary conditions at the clamp. The stress in platinum thin films has been measured on glass and single crystal silicon substrates as a function of thickness with substrate temperatures ranging from 100 C to 600 C. The stress was found to have a high tensile value at low temperatures, to decrease sharply at 300 C and to be very small at 500 C and 600 C. A comprehensive theory based on the structural observations was proposed. The high tension at 100 C was explained by the interaction at the grain boundaries. The decrease in stress at 300 C was ascribed to diffusion in the growing film. The small stress at 500 C and 600 C was the result of a larger grain size. Author

N71-19199# National Science Foundation, Washington, D.C.
ACHIEVEMENTS AND PROSPECTS OF INVESTIGATIONS ON PROBLEMS OF DIFFUSION OF SUBSTANCES IN SOLID STATE [DOSTIZHENIYA I PERSPEKTIVY ISSLEDOVATESKOI RABOTY NAD PROBLEMARMI DIFFUZII VESHCHESTVA V TUERDYKH TELAKH]
V. I. Arkharov 1970 68 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Ural. Fil., Inst. Fiz. Met., Tr. (Sverdlovsk), no. 12, 1949 p 94-120 Prepared in cooperation with NBS
(TT-70-57079; DMDC-5404) Avail: NTIS CSCL 20L

A review is presented of early Soviet work on diffusion in solids. The emphasis is on the more practical aspects of diffusion. Most references are of East European origin. Subject coverage, as well as materials reviewed, is broad in scope. Author (GRA)

N71-19207*# Rice Univ., Houston, Tex.
ON THE ELASTIC APPROXIMATION TO THE VACANCY FORMATION ENERGY IN METALS
W. J. Arnoult, K. Salama, and J. M. Roberts [1970] 24 p refs
(Grant NGL-44-006-001)
(NASA-CR-116881) Avail: NTIS CSCL 20L

An isotropic elastic continuum model proposed to describe point defects in metals is modified to calculate the energy and entropy of vacancy formation. The vacancy core is considered as a defect having elastic properties different from those of the surrounding lattice. The boundary conditions are satisfied on the interface between the vacancy core and the lattice region so as to render the defect in the host lattice free of external stress, pressure, or body force. The ratio of vacancy volume to atomic volume is considered to be equal to the experimentally determined value. The Voigt average of the single crystal elastic constants is employed in the calculations. Good agreement is obtained between theory and experiment for a variety of metals. Author

N71-19273# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM. THEORY OF THERMOELECTRIC POWER IN METALS AND ALLOYS
P. E. Nielsen and P. L. Taylor Jun. 1970 85 p refs
(Contract AT(11-1)-623)
(COO-623-152; TR-65) Avail: NTIS

The electron diffusion thermoelectric power (thermopower) of metals and dilute alloys is investigated over a wide range of temperatures in a simple model of free electrons with scattering characterized by a relaxation time. It is found that second-order corrections to the T-matrix for electron scattering involving intermediate virtual phonon states result in strongly energy-dependent corrections to the relaxation time, and thus greatly influence the thermopower. The primary results are first, that there exists a contribution to the electron diffusion thermopower of a metal which has the same magnitude and general temperature-dependence as that due to phonon-drag, and second, that there is a term in the thermopower of an alloy which is strongly dependent upon the type of impurity present, and is important at low temperatures. The significance of these results in interpreting experimental data is discussed. Author

N71-19279 California Univ., Los Angeles.
THE ELASTIC DISPLACEMENTS BY A POINT DEFECT IN A CUBIC MEDIUM BY THE FOURIER TRANSFORM METHOD
Robert Akira Masumura (Ph.D. Thesis) 1969 194 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 70-2238

From the displacements, the stress and strain fields are obtained and are employed in the investigation of the interactions between a point defect and dislocation and a point defect and point defect. The model used for the point defect is composed of three equal and orthogonal double-forces which are aligned with the cube axes of a medium with cubic crystal symmetry. The mathematical representation of the point defect is inserted as the body force term in Navier's differential equation. The solution of these partial differential equations yield the displacements produced by the point defect. The method of Fourier transforms is employed to solve for the displacements. The exact solution for the displacement field is obtained. The solution for the weakly anisotropic medium is also investigated. Dissert. Abstr.

N71-19285*# Stanford Univ., Calif. Solid-State Electronics Lab.
THE ELECTRONIC STATES AND ELECTRON-LATTICE INTERACTION IN THE SILVER HALIDES: PHOTOEMISSION STUDIES
Robert Steven Bauer Dec. 1970 306 p refs
(Grant NGR-05-020-066)
(NASA-CR-116852; SU-SEL-70-081; TR-5218-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 20L

Photoemission from the silver halides was studied between room and liquid nitrogen temperatures in order to investigate the electron energy states of these solids. Certain structure in the energy distribution curves (EDC) of electrons photoemitted from these compounds was discovered to sharpen by an order of magnitude more than the change in thermal energy. The techniques developed to measure the dependence of UV photoemission on temperatures ranging continuously from 295 to 80 K are described. From a detailed discussion of the possible effects of temperature variation on photoemission from solids, it is suggested that the dramatic EDC temperature dependence is due to a very strong interaction of the electrons with lattice. A model is proposed to describe this

phenomenon, in which the dynamic variations of the electronic states are caused by a fluctuating valence, halogen p-silver d mixing due to the thermal vibrations of the lattice. Applying this dynamic wavefunction hybridization model in a general way, the silver states with almost pure 4d symmetry could be located by experiment with reasonable certainty; these locations were 3.7, 3.3, and 4.4 eV below the highest filled states in AgBr, AgCl, and AgI, respectively. Author

N71-19291*# Rice Univ., Houston, Tex. Dept. of Physics.
AN EPR INVESTIGATION OF THE DYNAMIC JOHN-TELLER EFFECT IN SrCl2-La(2+)
J. R. Herrington, T. L. Estle, and L. A. Boatner (LTV Res. Center, Dallas, Tex.) [1970] 52 p refs Sponsored in part by NSF
(Grant NGL-44-006-001)
(NASA-CR-116883) Avail: NTIS CSCL 20L

The electron paramagnetic resonance spectrum for SrCl2:La(2+) was observed between 1.2 K and 40 K. At 1.2 K, the dominant structure is anisotropic and is described within experimental error by second-order solutions of the effective Hamiltonian for an isolated 2Eg state split by large random internal strains. This structure is shown to result from rapid direct relaxation between the strain-split vibronic states. At temperatures above approximately 6 K, only the isotropic structure was observed. Author

N71-19292# Israel Program for Scientific Translations, Lt., Jerusalem.
MOBILITY OF ATOMS IN CRYSTAL LATTICES
V. N. Svechnikov, ed. 1970 96 p refs Transl. into ENGLISH of 'Podvizhnost Atomov v Kristallicheskoi Reshetke' Kiev, Izvo., 1965 Sponsored by NBS and NSF Prepared for NBS and NSF
(TT-70-50029) Copyright. Avail: NTIS CSCL 20L

Contents: Current microscopic theory of diffusion in metals and alloys; Methods of calculating the coefficients of interdiffusion; Relaxation method of studying point defects of the crystal lattice in metals; Activation energy of self-diffusion in metals; Some regularities in the variation of the parameters D sub 0 and Q in diffusion in metals and alloys; On the diffusion mechanism in liquid metals; Elastic interaction of solute atoms with the structural stress fields and its effect on diffusion processes in the decomposition of solid solutions; Diffusion of nickel in the Ni3Al-Ni3Ti system; Structural defects and diffusion along phase boundaries; Diffusion in two-phase alloys; Crystal-latice defects in a thin wire; Heat treatment of vacuum condensates of silver, copper, and tin; Some laws of oxygen diffusion in titanium. GRA

N71-19295 Stanford Univ., Calif.
ON DENDRITIC GROWTH
Ernest Gunther Holzmann (Ph.D. Thesis) 1969 339 p
Avail: Univ. Microfilms: HC $15.30/Microfilm $4.35 Order No. 70-1548

Starting with the traditional time-invariant model of diffusion-controlled crystal growth in a supercooled melt, the boundary value problem is solved for the temperature and flux fields inside and around two ideal crystal shapes, namely, the paraboloidal needle and the parabolic platelet. The cases considered include not only the pure crystal, but also growth from a dilute binary solution. The solution of the boundary value problem in each case takes the form of an infinite series with terms involving products of Laguerre polynomials and Kummer functions. To justify the term-by-term differentiation needed for the flux calculations, the formal series are shown to converge uniformly in every compact domain. Two interesting results appear from the computation; first, the interface temperature gradient in the solid changes sign at one point behind the crystal tip; second, the heat imbalance at the interface is uniformly of one sign, thus tending to increase the normal growth rate everywhere behind the tip. Dissert. Abstr.

N71-19304# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM. ACCURATE DETERMINATION OF THE DIELECTRIC CONSTANT BY THE METHOD OF SUBSTITUTION
Carl Andeen, John Fontanella, and Donald Schuele Mar. 1970 21 p refs
(Contract AT(11-1)-623)
(COO-623-150; TR-63) Avail: NTIS

A substitution method for highly accurate determination of the static dielectric constant of solids is presented along with techniques for refining capacitance measurements. The results for some alkaline earth fluorides are CaF2: 6.799, SrF2: 6.466, and BaF2: 7.359, and an alkali halide, KCl, is 4.818. Author

N71-19305# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM. LOW FREQUENCY DIELECTRIC CONSTANTS OF THE ALKALINE EARTH FLUORIDES BY THE METHOD OF SUBSTITUTION
Carl Andeen, John Fontanella, and Donald Schuele 1970 22 p refs
(Contract AT(11-1)-623)
(COO-623-154; TR-67) Avail: NTIS

The 1000 Hz 300 K dielectric constants of the alkaline earth fluorides were measured to an accuracy of 0.01% by the method of substitution. Reproducibly different values for various crystals of the same type were obtained which varied beyond the experimental error. The ranges of results for various crystals of each type measured, along with further separation by manufacturer are: CaF2, Harshaw, 6.7984-6.7988, Optovac, 6.8074-6.8432; SrF2, Harshaw, 6.4647-6.4664, Optovac, 6.4700-6.4703; and BaF2, Harshaw, 7.3590-7.3595, Optovac, 7.3606-7.3630. The spread for each type of crystal is thought to be attributable to random trace impurities. Author

N71-19306 Lehigh Univ., Bethlehem, Pa.
EFFECTS OF CRYSTALLOGRAPHY AND THERMO-MECHANICAL TREATMENT ON FATIGUE CRACK PROPAGATION
John Herbert Weber (Ph.D. Thesis) 1969 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-1750

The effect of crystal orientation and material processing on fatigue crack propagation was examined for 70/30 brass and type 305 stainless steel. Trends in microscopic features on the facets were best correlated with respect to crystallographic orientation of the facet plane. Surface morphology near the facet periphery exhibited a plateau and ledge structure resulting from a combined effect of crystal plane fracture and grain boundary restraint. Fracture surface features adjacent to twin boundaries showed a distinct correlation on opposing sides of the composition plane, while no such correlation was present across grain boundaries. The effect of material processing on crack propagation rates of coarse-grained, cold-worked, and recrystallized 70/30 brass and 305 stainless steel was found to have a secondary role in controlling growth as compared to that of the stress intensity factor. Variations in crack growth behavior for different orietnations in textured sheet were related to mechanical fibering. Dissert. Abstr.

N71-19307# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM. CAPACITIVE GAGE FOR THE ACCURATE MEASUREMENT OF HIGH PRESSURES
Carl Andfen, John Fontanella, and Donald Schuele Oct. 1970 23 p refs
(Contract AT(11-1)-623)
(COO-623-155) Avail: NTIS

A highly accurate and precise pressure gage which utilizes the 35 C, 2000 Hz dielectric constant of an ionic crystal, CaF2, is described. The accuracy, stability, and convenience of such a

gage are discussed comparing it to dead weight and Manganin wire resistance gages. From a calibration at the National Bureau of Standards, the defining equation was found to be: C/C sub O = 1 − AP + BP(2) where C sub o is the zero pressure capacitance, C is the capacitance at absolute pressure P, and the characteristic contents are: A = 2.603 × 10 to the minus 7th power/(psi) and B = 1.302 × 10 to the minus 13 th power 1 sq (psi). Author

N71-19308 Rensselaer Polytechnic Inst., Troy, N.J.
EFFECTS OF RECOILLESS EMISSION ON gamma-gamma ANGULAR CORRELATION IN Sn-119
Harvey Lewis Berger (Ph.D. Thesis) 1969 284 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 70-2608

The degree of perturbation of the gamma-gamma angular correlation function W(theta) is related to the probability of recoilless emission. A theory is presented in which it is proposed that in certain types of crystals recoilless radiation originates in regions of the sample where the perturbing fields are either small or absent. For such radiation W(theta) should be the same as the unperturbed result. Two examples of perturbing fields were treated theoretically: a static magnetic field interacting with the nucleus through the dipole moment in the intermediate state of the cascade, and a static electric field gradient interacting with the nuclear electric quadrupole moment of the intermediate state. The latter interaction proved to be more useful for purposes of experimentally studying the theoretical predictions. Dissert. Abstr.

N71-19309 Utah Univ., Salt Lake City.
CALCULATION OF ENERGY BANDS AND L BANDS IN ALKALI HALIDE CRYSTALS
Larry James Page (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 70-2461

Two distinct but related calculations are presented. The first calculation is of the valence and conduction electronic energy bands in LiF, NaCl and KBr. The valence and conduction band of KCl is also calculated to compare with a previous calculation. The bands are calculated by the Augmented-Plane-Wave (APW) method. In the second calculation, the optical absorption bands which are associated with F centers, and known as L bands, are calculated for NaCl and KCl. The semicontinuum and effective mass approximations are used to calculate excited states of the F center which lie in the conduction band. With (1) these wave functions, (2) an assumed form for the ground state wave function, and, (3) a density of final states calculated by an interpolative method, the absorption cross section is calculated. Dissert. Abstr.

N71-19329 City Univ. of New York.
RADIATION DAMAGE IN MOLECULAR CRYSTALS
Herbert Ringel (Ph.D. Thesis) 1969 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 70-1116

The effect of Co-60 gamma radiation on some of the electrical and optical properties of high purity single crystals of anthracene, naphthalene, and phenanthrene was examined. The irradiations were performed at ambient temperature. A study was also made of the color center production and annealing in single crystals of anthracene, naphthalene, and phenanthrene exposed to high doses of gamma radiation. Dissert. Abstr.

N71-19349# Argonne National Lab., Ill. Chemistry Div.
ATTEMPT TO DEMONSTRATE THE EXISTENCE OF CHEMICALLY BOUND NEUTRONS
Sherman Fried, Arnold Friedman, and Morris Wahlgren Aug. 1970 7 p refs
(Contract W-31-109-eng-38)
(ANL-7729) Avail: NTIS

The delayed emission of neutrons from a cooled (4 K) crystal of LiF, which contained trapped electrons and which had been exposed to the neutron beam from a Cockcroft–Walton generator has been reported previously. When the irradiated crystal was removed from the liquid helium cooling bath and allowed to warm up in a neutron counter, approximately two neutrons could be observed per experiment. These neutrons were emitted at a rate corresponding to a half-time in LiF of approximately 30 sec. These experiments suggested that the neutrons from a Cockcroft-Walton generator were somehow bound in the LiF crystal at low temperatures and were released as the crystal became warm. Attempts were made to duplicate these experiments using conditions as nearly identical as possible, even to the extent of using an LiF crystal like that used originally. No effect such as that described could be observed. Author (NSA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-18713*# TRW Systems, Redondo Beach, Calif.
TASK 4 SPACE STORABLE PROPELLANT MODULE ENVIRONMENTAL CONTROL TECHNOLOGY
O. O. Haroldsen 16 Nov. 1970 155 p refs
(Contract NAS7-750)
(NASA-CR-116789; TRW-14051-6005-T0-00) Avail: NTIS CSCL 21I

A detailed analysis of the B2H6/OF2 propulsion module was performed and the results are given. The analysis considered all phases of the mission, including groundhold. The approach used was to first establish the thermal characteristics and temperature histories of the propulsion module during its life, followed by an analysis of the propulsion system. The results show that the thermal control system, as designed maintains the required thermal environment throughout the mission. It also shows that considerable mission variations can be accommodated without ill effects. The investigation shows that, though louvers aid in controlling the module temperature, they are not effective. For this reason, unless a remotely controlled louver mounted on the RTG is acceptable, it is recommended that a totally passive thermal control system be utilized. Because of the accuracy of spacecraft thermal analyses, an experimental program is recommended. Author

N71-18796*# Rocketdyne, Canoga Park, Calif. Advanced Systems.
SPACE STORABLE PROPELLANT VACUUM PERFORMANCE EVALUATION Final Report
B. J. Waldman Mar. 1970 89 p refs
(Contract NAS7-741)
(NASA-CR-116788; R-8151) Avail: NTIS CSCL 21I

Rocket engine tests with the propellant combination oxygen difluoride/diborane were conducted in an altitude simulation facility. Performance and heat transfer data were recorded for three different injector configurations. The tests are described and significant findings are reported. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-18429*# National Aeronautics and Space Administration., Washington, D. C.

TURBOFAN ENGINE FOR SHUTTLE

30 Jun. 1970 12 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970

(NASA-TM-X-66716) Avail: NTIS CSCL CSCL 21A

The characteristics, costs, and necessary technological developments for the jet engines required for reentry of space shuttles are described. ESRO

N71-18435*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

SPACE SHUTTLE AUXILIARY PROPULSION CONFIGURATIONS AND TECHNOLOGY

J. Thomson 1970 34 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970

(NASA-TM-X-66894) Avail: NTIS CSCL 21H

Both the booster and orbiter vehicles require a hydrogen-oxygen auxiliary propulsion system for attitude control, orbiting, and reentry. The necessary auxiliary propulsion configurations and technology for the space shuttle are described. ESRO

N71-18560*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

COMBUSTION STABILITY LIMITS FOR SWIRL JET COMBUSTOR MODULES COMBINING AIR SWIRL AND IMPINGING JET ATOMIZATION OF ASTM A-1 FUEL

Robert D. Ingebo Washington Mar. 1971 13 p refs

(NASA-TM-X-2218) Avail: NTIS CSCL 21E

Eight different designs of swirl-jet combustor modules were tested in a 3.25-inch-diameter duct with 600 F air at reference velocities of 200 to 500 feet per second and atmospheric pressure. The highest ratio of rich-to-lean combustion stability limits was obtained with a module consisting of a single air swirler, a single pair of 180 deg impinging fuel jets (0.076-cm diameter.), and a coiled-strip-type flame stabilizer. Results were considerably better than those obtained in recent investigations using swirl-can combustor modules. Author

N71-18714*# Dynasciences Corp., Blue Bell, Pa. Scientific Systems Div.

PRACTICAL ENGINEERING METHODS FOR PREDICTING HOT GAS REINGESTION CHARACTERISTICS OF V/STOL AIRCRAFT JET LIFT ENGINES

L. Gray and E. Kisielowski Feb. 1971 171 p refs

(Contract NAS1-9465)

(NASA-CR-111845; DCR-323) Avail: NTIS CSCL 21E

Engineering methods are presented for predicting the temperatures and velocities in the vicinity of vertical lift engines of jet V/STOL aircraft operating near the ground. The methods are based on existing theoretical analyses, available test data, and empirical and semiempirical approaches. Parametric variations in engine nozzle diameter, pressure, temperature, height, and ambient crosswind velocity are considered for single-, two-, and four-nozzle (rectangular) arrangements. Author

N71-18732# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

TECHNOLOGY AND METROLOGY APPLIED TO THE ION CESIUM MICROTHRUSTOR DEVELOPMENT [METHODES TECHNOLOGIQUES ET METROLOGIQUES APPLIQUEES AU DEVELOPPEMENT DE MICROPROPULSEURS A IONS DE CESIUM]

Emile Le Grives and Jean Labbe 1970 34 p refs In FRENCH Presented at the CNES Colloq. sur la Propulsion Ionique et son Appl. a la Stabilisation des Satellites, Toulouse, 25–26 Jun. 1970 Submitted for publication

(ONERA-TP-847) Avail: NTIS

An account is given of the research work on electrostatic acceleration of cesium ions in contact with tungsten. The experimental design of the cesium feeding system and the ion extraction device is outlined and technological methods developed for the fabrication and welding of porous tungsten, for the control of porosity, permeability, and thermal emissivity are analyzed. Results obtained with an optical extraction system are discussed. ESRO

N71-18733*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

PARAMETRIC ENGINE STUDY FOR A MACH 0.98 COMMERCIAL AIR TRANSPORT

John B. Whitlow, Jr., Gerald A. Kraft, and Kestutis C. Civinskas Feb. 1971 33 p refs

(NASA-TM-X-52961- E-6154) Avail: NTIS CSCL 21E

Advanced engine weight technology, compatible with a mid-decade introduction into commercial service, was used in the study of the three-engine, 300-passenger airplane with the supercritical wing. A takeoff gross weight of 386,000 pounds was selected to provide a range of about 3000 nautical miles. Fan pressure ratios (FPR) from 1.50 to 2.25 and takeoff turbine-inlet temperatures from 2460 to 2860 R were considered. Significant improvements in range were obtained by raising the FPR over this spectrum when bypass ratio (BPR) and overall pressure ratio (OPR) were optimized. An increase in inlet temperature over the spectrum considered here had much less effect on range than an increase in FPR. Neither the approach nor the (lift-off) sideline noise requirements of F.A.R. could be met with any of these engines without acoustic treatment of the nacelles. Even with acoustic treatment, only one-stage fan engines could meet the approach requirement for the maximum suppression of 15 PNdb assumed in this study. Unfortunately, FPR must therefore be limited to about 1.7. Author

N71-18801# Curtiss-Wright Corp., Wood-Ridge, N.J.

WTF-48 SINGLE ROTOR COMPRESSOR DEVELOPMENT Final Technical Report

Charles H. Muller 6 Nov. 1970 61 p refs

(Contract N00019-69-C-0533)

(AD-715626; CW-WR-69-098F) Avail: NTIS CSCL 21/5

Development of the reduced scale WTF-48 lift fan engine was continued under this program. The objective of the program was improvement of the pressure ratio, efficiency and diffusion of the compressor rotor. This program investigated the effects of deblunting and sweep of the rotor trailing edge and modification of the passage area schedule and wall contours. The modifications investigated in this program did not produce increased rotor pressure ratio or efficiency. An increase of 11% in rotor static pressure, accompanied by a 20% reduction in diffuser losses, was accomplished. This improvement produced a 5 point increase in stage efficiency of the compressor. Author (GRA)

N71-18863*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

EFFECT OF EXIT AREA VARIATION ON THE PERFORMANCE OF AN AUXILIARY INLET EJECTOR NOZZLE AT MACH NUMBERS FROM 0 TO 1.27

Bernard J. Blaha and Albert L. Johns Washington Mar. 1971 38 p refs

(NASA-TM-X-2182; E-5945) Avail: NTIS CSCL 21A

An auxiliary inlet ejector nozzle designed for a supersonic-cruise aircraft was tested in the Lewis 8 by 6 foot supersonic wind tunnel to determine the effect of internal expansion on the performance of the nozzle, especially at subsonic cruise. Internal area ratio was

varied from 2.0 to 3.7 with a series of fixed exit areas simulating the movement of a triple-hinge, trailing-edge flap. A smaller primary area simulated subsonic cruise and dry acceleration and a larger primary area simulated reheat acceleration. The nozzles were tested over a range of nozzle pressure ratio from 1.9 to 8.0. At a subsonic-cruise Mach number of 0.9 and a nozzle pressure ratio of 3.2, an increase in internal expansion from 2.0 to 2.9 reduced the nozzle gross thrust coefficient about 1.0 percent. A further increase in expansion ratio to 3.74, however, resulted in an additional 10-percent loss in performance. Author

N71-19139*# TRW Systems Group, Redondo Beach, Calif.
A STUDY OF THE USE OF LIQUID BASE FOAMS FOR JET NOISE REDUCTION
L. Manson, S. Lieberman, and H. L. Burge Washington NASA Feb. 1971 142 p refs
(Contract NAS1-9426)
(NASA-CR-1695) Avail: NTIS CSCL 20A

An experimental investigation of the acoustical properties of liquid base foams and of jet noise reduction through foam injection is discussed. Results are given for an analytical effort to build a mathematical model of the sound propagation and absorption of foams. The experimental investigation showed attenuation constants on the order of 3 nepers/inch. Jet noise reduction values up to 10 PNdB were recorded. The analytical effort confirmed the hypothesis of a resonant response of foams to sound waves. The overall results indicate foam has a high potential as a sound attenuation medium. Author

N71-19177# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE AGARD PROPULSION AND ENERGETICS PANEL 34th MEETING, (8TH COLLOQUIUM) ON REACTIONS BETWEEN GASES AND SOLIDS
S. S. Penner (California Univ., La Jolla) and P. G. Atkinson, Jr. (Directorate of Labs., Andrews AFB, Md.) Feb. 1971 12 p Conf. held at Dayton, Ohio, 13–16 Oct. 1969
(AGARD-AR-32-71) Avail: NTIS

A report of the round table discussion and a critical review of the presentations are given. There was general agreement that the interdisciplinary character of the meeting had led to a fruitful exchange of views by giving new perspectives to the participants on areas of application of their work and on desirable directions for new studies. Author

N71-19178*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF A 20-cm DIAMETER ELECTRON BOMBARDMENT HOLLOW CATHODE ION THRUSTER
E. V. Pawlik 15 Feb. 1971 17 p refs
(Contract NAS7-100)
(NASA-CR-116828; JPL-TM-33-468) Avail: NTIS CSCL 21C

Experimental system studies on solar-electric primary propulsion for deep space probes are under way. These studies are performed with a 20-cm-diameter electron-bombardment ion thruster. The electron emitter used to create the thruster plasma was changed from an oxide to a hollow cathode type to improve thruster efficiency and lifetime. The performance of this modified thruster is detailed over a wide range of variations in thruster parameters. Thruster output power can be varied from 1000 to 2600 W. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-18227# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
A DISCUSSION ON SOME RECENT RESULTS ON COSMIC RAY MUONS
C. Castagnoli, E. Etim, and P. Picchi 10 Jul. 1970 15 p refs /ts Note No. 484
(LNF-70/32) Avail: AEC Depository Libraries

The discussion of recent results on cosmic muons and their interpretation covers muon production, horizontal air showers, and the zenith-angle distribution of high-energy muons. NSA

N71-18392# California Univ., Irvine.
RESEARCH PROGRAM IN NEUTRINO PHYSICS, COSMIC RAYS, AND ELEMENTARY PARTICLES Progress Report, 1 Oct. 1969–30 Sep. 1970
F. Reines Aug. 1970 51 p refs
(Contract AT(11-1)-Gen-10)
(UCI-10-P-19-40) Avail: NTIS

Research is reported on neutrino interactions, cosmic-ray muons, and neutrinos, and a search for quarks in the cosmic radiation. A list of publications is included. NSA

N71-18704# Smithsonian Astrophysical Observatory, Cambridge, Mass.
COSMIC RAY PRODUCTION OF DEUTERIUM, He3, LITHIUM, BERYLLIUM, AND BORON IN THE GALAXY
Henri E. Mitler 1 Dec. 1970 82 p refs
(SAO-Special-Rept-330) Avail: NTIS

The production of deuterium, He3, lithium, beryllium, and boron by galactic cosmic rays in the interstellar medium, over the life of the Galaxy, is calculated. When allowance is made for the interchange of material between stars and the interstellar gas and for the change of cosmic-ray intensity with time, the lithium, beryllium, and boron produced turn out to be ample to explain the observed abundances. It is also found that high-energy alpha-alpha reactions contribute to the observed lithium. Deuterium and He-3 are not produced in sufficient amounts. To explain the Li-7/Li-6 ratio measured terrestrially and in chondritic meteorites, cosmological production of Li-7 is suggested. This implies the production of deuterium and He-3 in amounts consistent with observation. The theory in its present form cannot explain a solar system Li-7/Li-6 ratio of 12 and stellar ratios as low as 3. Author

N71-18712# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
GAMMA RAY AND NEUTRON EMISSIONS FROM THE SUN
E. L. Chupp (New Hampshire Univ.) Sep. 1970 98 p refs Sponsored in part by NATO
(MPI/PAE-Extraterr-48) Avail: NTIS

Evidence for the acceleration of charged particles in the solar atmosphere is reviewed from the point of view of gamma ray and neutron production at the sun. Estimates of the fluxes of these components at the earth are considered along with the solar physics derivable from such observations. Estimates and conditions for obtaining observable fluxes from a dynamic dissipation model are also considered. Current research and suggestions for new programs are also discussed. Author (ESRO)

N71-18754*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PROBABLE SOLAR FLARE DOSES ENCOUNTERED ON AN INTERPLANETARY MISSION AS CALCULATED BY THE MCFLARE CODE
Gerald P. Lahti and Irving M. Karp Mar. 1971 11 p refs Presented at the Natl. Symp. on Nat. and Manmade Radiation in

Space, Las Vegas, Nev., 2–5 Mar. 1971; Sponsored by NASA and AEC
(NASA-TM-X-52971; E-4027) Avail: NTIS CSCL 03B

The computer program, MCFLARE, uses Monte Carlo methods to simulate solar flare occurrences during an interplanetary space voyage. The total biological dose inside a shielded crew compartment due to the flares encountered during the voyage is determined. The computer program evaluates the doses obtained on a large number of trips having identical trajectories. From these results, a dose D sub p having a probability p of not being exceeded during the voyage can be determined as a function of p for any shield material configuration. The user of the code selects any number of solar flares considered to be representative of the ones that will occur during future solar active periods. The flares are assumed to occur during these periods. The dose at a distance of 1 AU from the Sun from each of these flares behind any shield configuration investigated is input to the MCFLARE code. The code accounts for the dependence of the dose received from a flare on the distance from the Sun. From trajectory parameters, which are input to the computer program, the distance from the Sun as a function of time during the trip is calculated. Author

N71-18802# Stanford Research Inst., Menlo Park, Calif.
EXCITATION AND DEEXCITATION OF VIBRATION IN N2 BY OXYGEN ATOMS Semiannual Technical Report, 11 May–11 Nov. 1970
Graham Black, Donald C. Lorents, and Donald J. Eckstrom 7 Dec. 1970 24 p refs
(Contract DAHC04-70-C-0036)
(AD-715796; SATR-1) Avail: NTIS CSCL 7/4

The earths upper atmosphere continuously emits infrared radiation. It has been suggested that some of this radiation is powered by the energy stored in vibrationally excited nitrogen and that this is produced when nitrogen quenches O(singlet D). In this reaction the 1.96 eV electronic excitation of O(singlet D) is transferred to vibrational and rotational energy of the nitrogen and kinetic energy. However, no measurements of the fraction which appears as vibrational energy have been made. One of the tasks of the current program was to determine this fraction using Raman spectroscopy to determine the populations of the vibrational levels of nitrogen that are produced. In the E-region of the earths atmosphere, however, deexcitation of N2(vib) will probably be dominated by collisional quenching by electrons in the lower E-region and vibrational-translational energy exchange with O(triplet P) in the upper E-region. The reaction rate for the latter process is not known for temperatures found in the earths atmosphere. The shock tube is now fully instrumented, and preliminary measurements are underway. Author (GRA)

N71-18853# ARO, Inc., Arnold Air Force Station, Tenn.
THE EFFECTS OF PROTON IRRADIATION RATE ON THE SOLAR TRANSMITTANCE OF A THERMAL CONTROL BINDER MATERIAL Final Report, 4 Nov. 1969–15 May 1970
W. G. Kirby and D. W. Mills, Jr. AEDC Dec. 1970 35 p refs
(Contract F40600-71-C-0002)
(AD-715673; AEDC-TR-70-257) Avail: NTIS CSCL 18/8

An experimental investigation was conducted to study the effect of proton irradiation rate on the solar transmittance of a silicone rubber under a 10 to the -8th torr vacuum. Measurements were made with 150-kev protons. The effect of vacuum on the solar transmittance of the test material was negligible. The solar transmittance of the material appeared to decrease with decreasing irradiation rate. The solar transmittance of all samples was a power law function of the total energy accumulated per unit area of the sample between total energy levels of 10 to the 8th and 10 to the 10th ergs/sq cm/sec. Author (GRA)

N71-18919# Michigan Univ., Ann Arbor. Dept. of Astronomy.
BASIC SOLAR RESEARCH: THE SOLAR CHROMOSPHERE AND HIGH ENERGY RADIATION Final Report, 1 Jul. 1956–30 Sep. 1970
Orren C. Mohler and Helen D. Prince Oct. 1970 14 p refs
(Contract Nonr-1224(13))
(AD-715456; Rept-03112-1-F) Avail: NTIS CSCL 3/2

The report reviews a program directed towards basic research on the physics of the solar atmosphere and the effects of solar radiation on the earth. Continuing aid by ONR has played a significant role in the initiation and development of four general aspects of solar research: (1) Maps and analyses of high dispersion, high resolution solar spectra obtained with the McGregor Vacuum Spectrograph of the McMath-Hulbert Observatory; (2) Studies of solar activity with special emphasis on lambda-sweep spectroheliograms; (3) Research and development leading to improvements in solar instrumentation; (4) Investigations in solar-terrestrial relationships. Author (GRA)

N71-19293*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR WIND INTERACTION WITH MERCURY
N. F. Ness and Y. C. Whang (Catholic Univ. of America) Jan. 1971 27 p refs Submitted for publication Revised
(NASA-TM-X-65456; X-692-70-284-Rev) Avail: NTIS CSCL 03B

With the exception of its higher density, the planet Mercury is almost equivalent to the moon in many of its physical properties with respect to the solar wind interaction. The plasma and magnetic field in the wake region was studied using the guiding center approach, since the solar wind ion Larmor radius is very small compared to the planetary radius. A plasma cavity downwind from the obstacle and associated perturbation of the interplanetary magnetic field in the wake is predicted. Author

N71-19294*# Stanford Univ., Calif. Inst. for Plasma Research.
STRUCTURE OF THE CHROMOSPHERE-CORONA TRANSITION REGION
R. L. Moore and P. C. W. Fung Jan. 1971 49 p refs
(Grant NGL-05-020-272; Contract F4462-69-C-0008)
(NASA-CR-116872; SUIPR-377) Avail: NTIS CSCL 03B

The structure and energy balance of the chromosphere-corona transition region is investigated using a static, planar model which is compared with the results of XUV-resonance line observations. In this model, the transition region is heated by thermal conduction from the corona and cooled by radiative losses. Comparison of the model with observational results implies that this is the dominant process in the energy balance of the transition region, and that the base of the transition region is inherently nonstatic and/or nonplanar. The implications of results are discussed with regard to spicules. Author

N71-19297# Texas Univ., Austin. Coll. of Engineering.
VARIATIONS IN DAILY SOLAR RADIATION AT NATIONAL WEATHER SERVICE OBSERVING SITES IN TEXAS
Thomas O. Proffitt Feb. 1971 46 p refs
(Grant NSF GA-16822)
(Rept-27) Avail: Issuing Activity

The existence of an intraweekly cycle in air pollution in the urban environment is shown by the analysis of daily total solar radiation observations taken routinely by five National Weather Service stations in Texas: Brownsville, El Paso, Fort Worth, Midland, and San Antonio. Yearly, seasonal, and intraweekly variations in solar radiation attenuation are examined and the chi-square test is used to show significance of the results. Sundays receive, on the average, more solar radiation than other days while a minimum in solar radiation occurs near the middle of the week. This cycle is most easily observed during the winter months of December through February. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-18337# California Univ., Los Angeles. Dept. of Meteorology.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF THE RADIATION FIELD OF PLANETARY ATMOSPHERES Final Report, 1 Mar. 1967 –30 Jun. 1970
C. R. Nagaraja Rao and Z. Zekera Aug. 1970 6 p refs
(Contract F19628-67-C-0196)
(AD-715290; AFCRL-70-0497) Avail: NTIS CSCL 3/2

Detailed theoretical and experimental investigations of the problem of radiative transfer in planetary atmospheres have been made. Model atmospheres with progressive degrees of structural complexity have been investigated with a view to extending the theoretical solutions to the case of the real atmosphere. The effects of molecular anisotropy, turbidity and ground reflectivity have been taken into account in these theoretical studies. The experimental program was directed towards the evaluation of the polarization parameters of the emergent radiation in the atmosphere. Very extensive ground based and high altitude balloon-bourne measurements have been made. The ground-based measurements have been utilized to estimate the feasibility of techniques proposed to solve the inversion problem. The balloon measurements have been successfully inverted to derive information on the spectral reflective properties of the underlying terrain. These have been compared with laboratory measurements of the reflective properties of natural formations. The characteristic reflection matrices of some of the natural formations such as sands and soils have been determined.
Author (GRA)

N71-18338# Los Alamos Scientific Lab., N.Mex.
PROPOSAL FOR THE DETECTION OF MOTHER MOLECULES IN COMETS BY THEIR MICROWAVE LINES
Walter F. Huebner Oct. 1970 37 p refs
(Contract W-7405-eng-36)
(LA-4542) Avail: NTIS

A general proposal is made for radio detection of molecular transitions in comets. The importance of detecting cometary molecules is outlined and past attempts to observe comets with radio telescopes are discussed briefly. Relevant points for choice and observation of a comet and selection of a radio telescope are summarized. Tables of pertinent data for interesting molecules with known transitions in the microwave range are prepared for rapid access when observation of a comet is to be made.
Author (NSA)

N71-18375# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
OBSERVATIONS OF THE OWENS VALLEY RADIO OBSERVATORY. 9: POSITIONS OF 352 SMALL-DIAMETER RADIO SOURCES
Edward B. Fomalont and Alan T. Moffet 1970 15 p refs Submitted for publication
(Contract N00014-67-A-0094-0008)
(AD-714823; Rept-1970-9) Avail: NTIS CSCL 3/1

Positions, 1425 MHz flux densities and diameters or diameter limits are given for 352 small-diameter radio sources. The positions have estimated r.m.s. errors of about 2.5 seconds of arc. The majority of the sources have angular diameters of less than 30 seconds of arc in both the east-west and north-south directions.
Author (GRA)

N71-18377# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory
OBSERVATIONS OF THE OWENS VALLEY RADIO OBSERVATORY. 10: DUAL-FREQUENCY ORTHOGONAL STRIP DISTRIBUTIONS OF LINEARLY POLARIZED AND TOTAL RADIATION IN EIGHT EXTRAGALACTIC RADIO SOURCES
G. A. Seielstad and K. W. Weiler 1970 46 p refs Submitted for publication Sponsored in part by NSF
(Contract N00014-67-A-0094-0008)
(AD-714824; Rept-1970-10) Avail: NTIS CSCL 3/2

One-dimensional distributions of the total and linearly polarized radiation from 3C227, 3C270, 3C278 Cen A (central), 3C327, Her A, 3C353, and 3C403 have been obtained at frequencies of 1420 and 2880 MHz. Both right-ascension and declination scans are presented. Distributions of depolarization, rotation measure, and intrinsic polarization angle are calculated. Variations of spectral index within sources are noted. The magnetic field near the center of many radio galaxies is perpendicular to the major axis; in the outer components it is either approximately perpendicular or parallel. Correlations are found between rotation measure and depolarization rate in some cases.
Author (GRA)

N71-18391# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
QUASARS ARE STELLAR SYSTEMS
N. E. Kurochkin [1970] 5 p refs Transl. into ENGLISH from Astron. Tsirk. (USSR), no. 496, 28 Feb. 1969 p 3–7 In ENGLISH and RUSSIAN
(CISRO-Trans-10245) Avail: AEC Depository Libraries

Composite spectra of quasars 3C 273, 3C 48, 3C 245, 3C 446, and 3C 9 were constructed, assuming they were of stellar nature.
Author (NSA)

N71-18476*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEEP SPACE NETWORK SUPPORT OF THE MANNED SPACE FLIGHT NETWORK FOR APOLLO, 1962–1968, VOLUME I
F. M. Flanagan, P. S. Goodwin, and N. A. Renzetti 15 Jul. 1970 181 p refs
(Contract NAS7-100)
(NASA-CR-116801; JPL-TM-33-452-Vol-1) Avail: NTIS CSCL 22C

The development, engineering, and implementation activities are summarized of the Deep Space Network (DSN) in support of Manned Space Flight Network (MSFN) for Project Apollo from 1962 through 1968. In the field of Apollo telecommunications, the state of the art of the unified S-band system is traced through the development of the receiver/exciter and ranging subsystems implemented in both the DSN and MSFN. A detailed account is presented of the operational support the DSN provided to the MSFN from Apollo 4 to the moon orbiting flight of Apollo 8.
Author

N71-18477*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MATHEMATICAL MODELLING BY SYMBOLIC MATHEMATICAL COMPUTATION: A COSMOLOGICAL APPLICATION
James C. Howard Washington Mar. 1971 30 p refs
(NASA-TN-D-6233; A-3700) Avail: NTIS CSCL 22A

The advantages of symbolic mathematical computation are most evident in problems analogous to those described; that is, the application of the method of reconstructing several existing cosmological models and their associated trajectory equations. The field equations that govern the trajectories of bodies in space have, in general, large numbers of terms, with each term a complicated mathematical expression. The evaluation of these terms and the

derivation of the equations of the geodesics that describe the trajectories of bodies in space, require a substantial amount of algebraic manipulation and symbolic differentiation. For the models considered, the required operations were executed with speed and efficiency on an IBM 360/67 computer. For example, in the case of the nonhomogeneous Schwarzschild model, the computer times required to formulate the field and trajectory equations were 0.74 and 0.30 minutes. By mechanization of the procedure in the manner described, man hours are saved, the possibility of error is reduced, and the scope of the inquiry may be extended. Author

N71-18626*# Harvard Coll. Observatory, Cambridge, Mass.
LUNAR NOMENCLATURE Final Report
Donald H. Menzel Feb. 1971 47 p refs
(Grant NGR-22-007-194)
(NASA-CR-116798) Avail: NTIS CSCL 03B

The assignment of names to craters on the far side of the moon is reported. In addition to the biographical data, the coordinates of the craters assigned to each name have been added to the listings. G.G.

N71-18627*# Avco Corp., Tulsa, Okla. Electronics Div.
ANALYSIS OF MARINER 6 AND 7 DATA FOR GEOCHEMICAL IMPLICATIONS Final Report
Benton C. Clark Jan. 1971 90 p refs
(Contract NASw-2103)
(NASA-CR-116785) Avail: NTIS CSCL 22A

The results of the Mariner 6 and 7 experimental investigations have been analyzed for information relative to the problem of assessing the likely geochemistry of the Mars surface. Studies of television pictures reveal areas of the planet apparently very old and of a probable igenous-meteoritic composition. Other areas of the planet show evidence of extensive active processes which changed surface features to a composition of sedimentary nature. Infrared spectrometer data point to a silicate composition with some evidence for limonite or other iron oxides. Author

N71-18705*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL BIBLIOGRAPHY 39-12: PRERELEASE FOR NOVEMBER 1970
Nov. 1970 13 p refs
(Contract NAS7-100)
(NASA-CR-116804) Avail: NTIS CSCL 05B

The bibliography describes and indexes the formalized technical reporting resulting from scientific and engineering work. Four classes of publications are included: (1) technical reports in which the information is intended for a wide audience; (2) technical memorandums in which the information is intended for a limited audience to satisfy unique requirements; (3) articles from the four volume Space Programs Summary. Each volume's collection of articles presents a periodical survey of current accomplishments in the subject area covered by that volume; and (4) open literature articles that were not selected for reprint release as technical reports. Author

N71-18706*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL BIBLIOGRAPHY 39-12: PRERELEASE FOR DECEMBER 1970
Dec. 1970 44 p refs
(Contract NAS7-1000)
(NASA-CR-116803) Avail: NTIS CSCL 05B

The bibliography describes and indexes the formalized technical reporting resulting from scientific and engineering work. Four classes of publications are included: (1) technical reports in which the information is intended for a wide audience; (2) technical memorandum in which the information is complete for a specific accomplishment but is intended for a limited audience to satisfy unique requirements; (3) articles from the four volume Space Programs Summary and (4) open literature articles that were not selected for reprint release as technical reports. Author

N71-18707# Analysis and Computer Systems, Inc., Burlington, Mass.
SPACE FORECASTING DATA ASSOCIATION AND DISPLAY PROGRAM Final Report, 15 Nov. 1969 – 14 Jun. 1970
John A. Carbone, James R. Delaney, James A. Guarente, Arthur J. Markey, and John A. Fusco Sep. 1970 71 p refs
(Contract F19628-70-C-0084)
(AD-715931; AFCRL-70-0549) Avail: NTIS CSCL 3/2

The Space Forecasting Data Association and Display project is a Research and Development (R + D) effort performed at Air Force Cambridge Research Laboratories (AFCRL) in conjunction with the Air Weather Service. This R + D project is an effort to associate astrogeophysical data and display results of this association in order to enhance the operational capability of the Solar Forecast Center (SFC). The computer programs developed are to be part of a larger system to be executed on a series of Univac 1108 digital computers at Offutt Air Force Base, Omaha, Nebraska. The developed programs associate optically observed data to form Solar Regions and display elements of these regions on various graphs, charts, and listings to be utilized as forecasting aids and as pictorial representations in the Space Forecasting publication. Author (GRA)

N71-18872*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY 37-66, VOLUME 1: FLIGHT PROJECTS, 1 SEPTEMBER – 31 OCTOBER 1970
30 Nov. 1970 61 p refs
(Contract NAS1-100)
(NASA-CR-116808) Copyright. Avail: NTIS CSCL 22A

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2. MARINER VENUS-MERCURY 1973 PROJECT p 31–41 (See N71-18874 08-30)
3. VIKING PROJECT, ORBITER SYSTEM AND PROJECT SUPPORT p 42–56 refs (See N71-18875 08-30)

N71-18873*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 PROJECT
In its Space Programs Sum. 37-66, Vol. 1: Flight Proj., 1 Sep.–31 Oct. 1970 30 Nov. 1970 p 1–38 refs (See N71-18872 08-30)
Copyright. Avail: NTIS CSCL 22A

Continuing development and testing of spacecraft instrumentation and systems is reported. The mission and test computer system completed the real time system test support of the proof test model, using a data system based on the single Univac 1219 computer. Calibration of the reference and telemetry/monitor potentiometers was performed on the scan electronics proof test model. Sizing results for the attitude control gas nozzles show that the test range of the thrust stand was extended to 32 mlb, and test data and computer output are in agreement within 1% up to throats of 0.40 in. diameters. Analytical modeling of a peripheral belt drive magnetic tape transporter resulted in a better understanding of the mechanism inducing tape tension. The effects of propellant saturation with gaseous nitrogen on hydraulic resistance were determined for the modularized propulsion subsystem. The solvent effect on the biaxial properties of liquid propellant expulsion Teflon bladder bags was studied. Measured and computed mass properties were compared for dry and wet spacecraft. The codispersion propellant expulsion bladder was tested, and the spacer rod material was evaluated for the narrow-angle television camera. N.E.N.

N71-18874*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS-MERCURY 1973 PROJECT
In its Space Programs Sum. 37-66. Vol. 1: Flight Proj., 1 Sep.–31 Oct. 1970 30 Nov. 1970 p 31–41 (See N71-18872 08-30)
Copyright. Avail: NTIS CSCL 22A

The imaging experiment and error rates for science data words are discussed. The television subsystem is described along with its use in identifying the major physiographic properties of Mercury, the major surface features of Mars, and the cloud characteristics of Venus. A mathematical model, and conditional and error probabilities are presented for the error rates for data words time multiplexed onto 6-bit block-coded words. N.E.N.

N71-18875*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING PROJECT. ORBITER SYSTEM AND PROJECT SUPPORT
In its Space Programs Sum. 37-66. Vol. 1: Flight Proj., 1 Sep.–31 Oct. 1970 30 Nov. 1970 p 42–56 refs (See N71-18872 08-30)
Copyright. Avail: NTIS CSCL 22A

Spacecraft instrumentation and circuitry are described. Relay multipath simulation and test configuration are outlined, and the circuit design is presented for automated sensing of sun occutation and associated logic. The articulation control subsystem and a programmable formater for engineering telemetry are discussed. Separation interfaces are described for the spacecraft/Centaur adapter and the orbiter/lander adapter interfaces. N.E.N.

N71-18878*# Smithsonian Institution, Washington, D.C.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LUNAR SAMPLE ANALYSIS PROGRAM: A SUMMARY OF PHASE ANALYSIS ON APOLLO 12 SAMPLES Final Report
K. Fredriksson, J. Nelen, C. A. Andersen (Hasler Res. Center), and J. R. Hinthorne (Hasler Res. Center) 31 Jan. 1971 19 p refs
(Contract NAS9-8015)
(NASA-CR-114871) Avail: NTIS CSCL 03B

The relatively low Ti and high Fe content of the Apollo 12 fines and breccias indicate that a substantial part is derived from the local basalts. The high alkali content of at least a third of the glasses points to a second component with a composition similar to rock 12013, and trace analyses support this hypothesis. Although some constituents of the breccias are clearly derived by impact, the lithification is apparently mostly due to welding of hot particles and partly plastic, probably relatively silica and alkali rich material serving as a glassy cement. The heating and lithification process was rapid and caused little chemical differentiation, analogous to the formation of ignimbritic rocks. Author

N71-19144*# Oregon Univ., Eugene.
MINERALOGY AND PETROLOGY OF APOLLO 11 AND APOLLO 12 SAMPLES Final Report
Daniel F. Weill and I. Stewart McCallum 31 Jan. 1971 49 p refs
(Contract NAS9-8071)
(NASA-CR-114878) Avail: NTIS CSCL 03B

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1. PETROLOGY OF A FINE GRAINED IGNEOUS ROCK FROM THE SEA OF TRANQUILLITY D. F. Weill, I. S. McCallum, Y. Bottinga, M. J. Drake, and G. A. McKay 4 p refs (See N71-19145 08-30)

2. MINERALOGY AND PETROLOGY OF SOME APOLLO 11 IGNEOUS ROCKS D. F. Weill, I. S. McCallum, Y. Bottinga, M. J. Drake, and G. A. McKay 19 p refs (See N71-19146 08-30)

3. MINERALOGY AND PETROLOGY OF APOLLO 12 SAMPLE NO. 12013. A Progress Report M. J. Drake, I. S. McCallum, G. A. McKay, and D. F. Weill 21 p refs (See N71-19147 08-30)

N71-19145*# Oregon Univ., Eugene. Center for Volcanology.
PETROLOGY OF A FINE GRAINED IGNEOUS ROCK FROM THE SEA OF TRANQUILLITY
Daniel F. Weill, I. Stewart McCallum, Yan Bottinga, Michael J. Drake, and Gordon A. McKay *In its* Mineralogy and Petrology of Apollo 11 and Apollo 12 Samples 31 Jan. 1971 4 p refs Repr. from Science, v. 167, 30 Jan. 1970 p 635–638 (See N71-19144 08-30)
Avail: NTIS CSCL 03B

All phases in a thin section of sample 10022 were analyzed by electron microprobe. Augite grains show strong iron enrichment in the outer 15 to 20 microns. Pigeonite cores occur within augite grains. The plagioclase has an anorthite content of between 73 and 81 mole percent and is high in Si and low in Al compared to stoichiometric feldspar. Residual phases include microcrystalline Fe-rich pyroxene, plagioclase, K-rich alkali feldspar, silica, and rare areas rich in P and Zr with concentrations of Ba, Y, and rare earth elements. The density, viscosity, and crystallization history of the lava of sample 10022 are discussed. Author

N71-19146*# Oregon Univ., Eugene. Center for Volcanology.
MINERALOGY AND PETROLOGY OF SOME APOLLO 11 IGNEOUS ROCKS
Daniel F. Weill, I. Stewart McCallum, Yan Bottinga, Michael J. Drake, and Gordon A. McKay *In its* Mineralogy and Petrology of Apollo 11 and Apollo 12 Samples 31 Jan. 1971 19 p refs Repr. from Proc. of the Apollo 11 Lunar Sci. Conf., v. 1 p 937–955 (See N71-19144 08-30)
(Grant NGR-38-003-009)
Avail: NTIS CSCL 03B

Electron probe microanalysis of all minerals in ferrobasalt 10022-28 shows ilmenite crystals that are stoichiometric (Mg, Fe(2+)) TiO3 and unzoned. They show a large grain to grain variation in Mg content, with low Mg grains being platy in habit. Minute olivine grains and homogeneous primary pigeonite cores occur within most of the equant augite crystals. Compositional variation in the main body of the augites is less pronounced than in the sharply zoned rims. Overall zoning in augite is extensive but follows well-defined trends. Plagioclase shows little zoning, but is high in Si and low in Al compared to stoichiometric feldspar. Troilite-iron intergrowths are the product of a late-stage separation of immiscible sulfide liquids. Residual phases include microcrystalline Fe-rich pyroxene, quartzo-feldspathic residuum, silica and rare P and Zr rich areas with notable concentrations of Ba, Y and rare earths. Experiments show ilmenite to be the liquidus phase in 10022 liquid followed by pyroxene and at a later stage, plagioclase. The density and viscosity of various lunar magmas are calculated. The low viscosity of Apollo 11 lavas should result in thin flows of large areal extent. Density and viscosity calculations permit discussion of the role of crystal-liquid fractionation in the evolution of lunar igneous rocks. Author

N71-19147*# Oregon Univ., Eugene. Center for Volcanology.
MINERALOGY AND PETROLOGY OF APOLLO 12 SAMPLE NO. 12013 Progress Report
Michael J. Drake, I. Stewart McCallum, Gordon A. McKay, and Daniel F. Weill *In its* Mineralogy and Petrology of Apollo 11 and Apollo 12 Samples 31 Jan. 1971 21 p refs Repr. from Earth Planet. Sci. Lett. (Netherlands), v. 9, 1970 p 103–123 (See N71-19144 08-30)
(Grant NGR-38-003-009)
Avail: NTIS CSCL 03B

A mineralogical-petrological survey of Apollo 12 sample 12013 was made with petrographic microscope and electron microprobe. The rock is extremely heterogeneous and consists of at least two separate fragmental units (light and dark) permeated by a once-fluid granitic component. The fragmental material includes a wide variety of lithic and crystal fragments some of which have not yet been reported from other lunar samples. The granitic component is essentially bimineralic, with dominant potassic feldspar plus silica. Author

N71-19218# Lockheed Missiles and Space Co., Palo Alto, Calif.
LANDING TRACKS OF ORBITAL VEHICLES
I. Osokin 1970 7 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 12,1970 p 36–38
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Techniques for plotting the landing tracks of space vehicles are presented. Subjects discussed are: (1) visual observation of satellite passage, (2) Doppler effect, (3) radio interferometry, (4) trajectory analysis, and (5) selection of landing areas. Author

N71-19230# Lockheed Missiles and Space Co., Palo Alto, Calif.
KIK, SOLICITOUS HANDS OF THE EARTH
P. Agadzhanov et al 1970 6 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 11, 1970 p 36–38
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Methods for conducting command and control of manned spacecraft are discussed. The effectiveness of command and control systems is dependent upon the rational interlinking and optimal distribution of the functions between the onboard systems and the ground command measurement complex. One of the most important problems in controlling space vehicles is constant telemetry checking of the state of the crew and equipment, diagnosing the systems, checking the consumption of supplies, opportune discovery of deviations and faults, and processing of basic information. Author

N71-19231*# Australian National Univ., Canberra. Dept. of Geophysics and Geochemistry.
CLARKE MEMORIAL LECTURE: ORIGIN OF THE MOON
A. E. Ringwood [1970] 54 p refs *Its* Lunar Sci. Inst. No. 30
(Contract NSR-09-051-001)
(NASA-CR-116880) Avail: NTIS CSCL 03B

Investigations of the mineralogy and petrology of lunar samples as a means of determining the origin of the moon are presented. The age of the moon has been determined as 3.3 billion years. Similarity and differences of earth mantle structure and lunar samples are discussed. Theories of lunar origin are examined based on the fission, binary planet, and capture explanations. Author

N71-19232*# Australian National Univ., Canberra. Dept. of Geophysics and Geochemistry.
PETROGENESIS OF APOLLO 11 BASALTS AND IMPLICATIONS FOR LUNAR ORIGIN
A. E. Ringwood [1970] 75 p refs *Its* Lunar Sci. Inst. Paper No. 07
(Contract NSR-09-051-001)
(NASA-CR-116891) Avail: NTIS CSCL 03B

A theory of lunar origin based on the genetic relationship between Apollo 11 moon samples and terrestrial basalts is presented. A precipitation hypothesis is described which maintains that during the later stages of accretion of the earth, a massive primitive atmosphere developed which was hot enough to evaporate selectively a substantial portion of the silicates which were accreting upon earth. Subsequently, the atmosphere was dissipated and the relatively non-volatile silicate components were precipitated to form a swarm of planetesimals or moonlets, from which the moon accreted. Author

N71-19233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UBV: SUBROUTINE TO COMPUTE PHOTOMETRIC MAGNITUDES OF THE PLANETS AND THEIR SATELLITES
G. Pace 15 Feb. 1971 18 p refs
(Contract NAS7-100)
(NASA-CR-116826; JPL-TR-32-1523) Avail: NTIS CSCL 03A

A computer subroutine to compute the visual, blue and ultraviolet photometric magnitudes of the planets, their natural satellites, and the sun at varying observation distances and phase angles are presented. Currently available observational magnitude and phase function data are stored in the program and used in the computation. Author

N71-19240*# Stanford Univ., Calif. Dept. of Applied Mechanics.
THE MARTIAN BOW WAVE: THEORY AND OBSERVATION
John R. Spreiter and Arthur W. Rizzi [1970] 11 p refs
(Grant NGR-05-020-330)
(NASA-CR-116876) Avail: NTIS CSCL 03B

The relationship between the trajectory of Mariner 4 in its fly-by of Mars and the calculated location of a proposed Martian bow wave arising from interaction of the solar wind and the ionosphere has been refined by inclusion of aberration effects of the planet's motion about the Sun. The modified theory indicates that the bow wave was crossed twice during a 3-hr interval following the time of closest approach of Mariner 4 to Mars, instead of being missed slightly by the spacecraft. It is shown that the observed magnetic field changed abruptly at virtually the precise times of the shock crossings indicated by the theory. Although malfunction of the plasma probe prevents observational confirmation of these as shock crossings, this coincidence supports the recent suggestion of the magnetometer experimenters that a bow wave may have been traversed. It also supports the interpretation that the bow wave results from interaction of the solar wind with the ionosphere, and not with a weak planetary magnetic field. Author

N71-19241*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
LONG RANGE PLANNING FOR SOLAR SYSTEM EXPLORATION Final Report, Nov. – Oct. 1970
Nov. 1970 137 p refs
(Contract NASw-2023)
(NASA-CR-116893; A-9; ASR-7) Avail: NTIS CSCL 03C

Mission planning for solar system exploration is discussed. Subjects presented are: (1) the physical structure of the Saturn ring system, (2) Jupiter orbiter mission, (3) Mercury orbiter mission, (4) atmospheric entry at Uranus and Neptune, (5) interstellar missions, (6) comet rendezvous mission, (7) radar exploration of Venus, (8) launch vehicle selection for outer planet missions, and (9) future upper stage propulsion requirements. Author

N71-19242*# Scripta Technica, Inc., Washington, D.C.
THE PANORAMIC VIEWS OF THE LUNAR SURFACE, VOLUME 2
Yu. I. Yefremov, ed. NASA Feb. 1971 99 p Transl. into ENGLISH of the publ. 'Pervyye Panoramy Lunnoy Poverkhnosti. Tom 2' Moscow, Nauka Press, 1969
(Contract NASw-2036)
(NASA-TT-F-651) Avail: NTIS CSCL 03B

The soft landing of the automatic lunar probe Luna-13 on the surface of the Moon represents new progress in lunar studies by means of space vehicles. Luna-13 continued the long series of lunar studies that began with the first Moon rocket in 1959. The panoramic views of the lunar surface transmitted by

Luna-13 have substantially extended the material available for studying the structure of the Moon's surface. Luna-13 confirmed the earlier conclusions regarding the absence of an appreciable layer of dust, the presence of a great many surface rocks and the prevalence of negative relief forms. In addition, Luna-13 made the first direct measurements of the physicomechanical properties of the surface layer of the lunar soil, representing yet another forward step in the study of the nature of the Moon. The panoramic views obtained by Luna-13 are produced with documentary accuracy, together with the preliminary results of their analysis and a description and the results of the experiments made to investigate the physico-mechanical properties of the surface layer of the Moon.
Author

N71-19269# National Bureau of Standards, Washington, D.C.
TECHNICAL HIGHLIGHTS OF THE NATIONAL BUREAU OF STANDARDS Annual Report, Fiscal Year 1970
Feb. 1971 260 p refs
(NBS-SP-340) Avail: SOD $1.50 Catalog No. C13/10:340

The goals, organization, and programs of the National Bureau of Standards are presented. Subjects discussed are: (1) metrology, (2) fabrics, (3) air quality, (4) building technology, (5) basic standards, (6) materials research, (7) applied technology, (8) radiation research, (9) computer technology, and (10) information programs.
Author

N71-19301*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF ABUNDANCE ANALYSIS OF STARS IN THE SPECTRAL RANGE B5 THROUGH G2 Final Report
Stephen E. Strom Oct. 1970 26 p refs
(Grant NGR-22-024-001)
(NASA-CR-116862) Avail: NTIS CSCL 03A

The progress in the photometric and spectroscopic study of the blue stragglers, and the evolution of stars in clusters is summarized. Also included is a brief analysis of the super-metal-rich K-giant phenomena.
F.O.S.

N71-19302*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A STUDY OF THE BLUE STRAGGLERS IN THE OPEN CLUSTER NGC 7789
K. M. Strom (State Univ. of N.Y., Stony Brook), and Stephen E. Strom *In its* Study of Abundance Analysis of Stars in the Spectral Range B5 Through G2 Oct. 1970 12 p refs Repr. from Astrophys. J., Nov. 1970 (See N71-19301 08-30)
Copyright. Avail: NTIS CSCL 03A

Image-tube spectrograms and Stromgren 4-color and He photometry were obtained for twelve possible blue-straggler members of the open cluster NGC 7789. Membership was established for seven of these twelve blue-straggler candidates. From the data obtained, it was possible to test three competing hypotheses for the origin of these stars. Estimates of masses based on a match of photometry with model atmospheres showed that blue stragglers have masses appropriate to their location in the color magnitude diagram. Furthermore, of four blue-straggler members studied carefully for radial-velocity variations, all four exhibited definite changes in velocity. These observations suggest strongly that blue stragglers are members of binary systems in which mass exchange has taken place.
Author

N71-19303*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ON THE EVOLUTIONARY STATUS OF STARS ABOVE THE HORIZONTAL BRANCH IN GLOBULAR CLUSTERS
Stephen E. Strom, K. M. Strom (State Univ. of N.Y., Stony Brook), R. T. Rood (MIT), and I. Iben, Jr. (MIT) *In its* Study of Abundance Analysis of Stars in the Spectral Range B5 Through G2 Oct. 1970 8 p refs Repr. from Astron. and Astrophys. (Heidelberg), 24 Jul. 1970 (See N71-19301 08-30)
(Grants NGL-22-009-019; NSF NSF GP-11277
NTIS CSCL 03A

Spectra of 13 stars falling above the horizontal branch in the globular cluster M2, M10, M13, and M15 and NGC 6712 were obtained with the Carnegie image tube spectrograph at the Kitt Peak National Observatory. At least 11 and probably all of these stars are shown to be members on the basis of radial velocity measurements. Of this group, three stars are hot enough to show lines of He I, and to within the estimated errors, the abundance of helium is approximately the same as for Pop I B-stars. These three stars are very luminous and probably burning helium in a shell after a second ascent of the giant branch: that is, they are probably similar in evolutionary state to the cores of planetary nebulae. There is some evidence that in at least two of these stars (M10I33 and Voa Zeipel 1128 in M3) significant mixing between the surface and the interior has altered the surface composition. It is suggested that the remaining eight stars have left the horizontal branch and are burning helium in one shell and hydrogen in another. These eight stars are most likely the progeny of stars which occupied the very blue end of the horizontal branch. The latter are presumed to have lost a significant amount of mass. The evolutionary lifetimes of these stars above the horizontal branch are consistent with this suggestion for their origin.
Author

N71-19312*# Chicago Univ., Ill. Dept. of Biophysics.
HIGH VOLTAGE ELECTRON MICROSCOPY AND ELECTRON DIFFRACTION OF LUNAR PYROXENES
Humberto Fernandez-Moran, Mitsuo Ohtsvki, Stefan S. Hafner, and David Virgo *In its* Electron Microscopy in Microbiol. and Lunar Rock Analysis Dec. 1970 9 p Refs Repr. from Proc. Apollo 11 Lunar Sci. Conf., v. 1 p 409-417 (See N71-19311 08-14)
(Contract NAS9-8080; Grant NIH GM-13243)
Avail: NTIS CSCL 03C

Pyroxenes from lunar rock 10044-25, cleaved and sectioned by diamond knife ultramicrotomy, were examined by standard and high voltage electron microscopy and diffraction. Salient findings based on the evaluation of 2000 plates show uniform bands parallel to (001) which correspond to single crystal domains. The bands occur predominantly in iron-rich crystals and their widths vary from approximately 100 A to 600 A. Mossbauer spectra of the iron-rich crystals reveal magnetic hyperfine splitting at low temperatures. Correlation of the band structure with possible magnetic ordering is considered.
Author

N71-19316*# Chicago Univ., Ill. Dept. of Biophysics.
MOSSBAUER EFFECT AND HIGH VOLTAGE ELECTRON MICROSCOPY OF PYROXENES IN TYPE B SAMPLES
Humberto Fernandez-Moran, Stefan S. Hafner, Mitsuo Ohtsuki, and David Virgo *In its* Electron Microscopy in Microbiol. and Lunar Rock Analysis Dec. 1970 4 p refs Repr. from Sci., v. 167, 30 Jan. 1970 p 686-688 (See N71-19311 08-14)
(Contract NAS9-8080; Grant NIH GM-13243-05)
Avail: NTIS CSCL 03B

Site occupancy numbers for ferrous iron, magnesium, and calcium at the M1 and M2 sites in lunar clinopyroxenes are estimated from nuclear gamma ray resonant absorption spectra of Fe-57. The cation distribution is ordered; calcium and magnesium prefer M2 and M1, respectively. The distribution corresponds to an equilibrium at a temperature lower than 680 C. Crystals cleaved and sectioned by diamond-knife ultramicrotomy were examined by high -voltage (200 kV) electron microscopy and diffraction. Uniform 300- to 600-A-wide bands that correspond to single crystal domains were found. Correlation of the bands with magnetic ordering at low temperatures is considered.
Author

N71-19318*# National Aeronautics and Space Administration. Washington, D.C.
EXPERIMENT PROGRAM FOR EXTENDED EARTH ORBITAL MISSION. VOLUME 2: ENGINEERING AND TECHNOLOGY
1 Sep. 1969 636 p refs Revised
(NASA-TM-X-66891) Avail: NTIS HC $9.00/MF $0.95 CSCL 22A

Assuming completion of the Saturn AAP workshop experiments program, an experiments payloads plan was developed for the space station of the mid-seventies including three experiments program options. Each option was generated to accommodate varying levels of experiment accomplishments and assumed different levels of funding availability. Specifically, the hard core option will only provide information on the physical well-being of the astronaut and limited data regarding his ability to perform useful functions in space. The second option will, in addition, provide limited scientific data in the areas of solar astronomy and earth applications while providing additional information on man's capability to perform useful functions in support of scientific data gatherings. The third option will provide for exploratory experimental efforts in a number of scientific disciplines and will allow examination of man's usefulness in support of these scientific investigations, and, significantly, will provide conclusions regarding man's role in future exploration and exploitation of space. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-18430*# National Aeronautics and Space Administration, Washington, D.C.
SPACE TUG
Philip E. Culbertson 1970 38 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970
(NASA-TM-X-66713) Avail: NTIS CSCL 22B

The general operational requirements for a variety of space missions are given for the space tug, a multi-purpose reusable orbit-to-orbit transportation vehicle. The wide range of space tug energy requirements leads to a versatile modular design concept from which it can be concluded that high efficiency, structural design, and high performance engines are needed. ESRO

N71-18432*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE ENGINE
F. M. Stewart 1970 25 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970
(NASA-TM-X-66896) Avail: NTIS CSCL 21H

The rocket engines for both the booster and orbiter elements of the space shuttle will be throttleable high performance hydrogen/oxygen engines. Depending on the design, the orbiter may use two or three engines while the booster may require ten or more. As is the case with most space vehicle launch systems, the pacing item is the engine. The space shuttle main engine requirements and concepts, and the approach to development as presently envisioned are described. Author (ESRO)

N71-18433*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
SPACE SHUTTLE TECHNOLOGY: AERODYNAMICS
Arthur Henderson, Jr. 1970 46 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970
(NASA-TM-X-66897) Avail: NTIS CSCL 22B

In space shuttle design, a problem is constituted by the dependence of safe separation on the unknown dynamic damping derivatives, the need for which is shown to be large by comparing the minimum safe separation value with the estimated interference-free value for the same flight condition. The feasibility of establishing the actual range of dynamic damping derivatives for both vehicles interfering through their flow field will have to be satisfactorily demonstrated. Author (ESRO)

N71-18434*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
TECHNOLOGY: STRUCTURES AND THERMAL PROTECTION SYSTEMS
Roger A. Anderson 1970 48 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970
(NASA-TM-X-66715) Avail: NTIS CSCL 22B

The principal uncertainties currently of concern to the space shuttle structural designer are identified. Those uncertainties which are specific to the mission but relatively independent of aerodynamic configurations are amenable to attack in a technology development program. Some of the highlights of this program, which is focused on those technical areas where design data and confidence is deficient and where a significant potential for saving structural weight is evident, are described. The program is designed to produce results in the time scale currently anticipated for development of the shuttle. There are numerous problem areas for which more definitive data or better design solutions are still being sought. It is anticipated that as mission simulation testing proceeds unforeseen problem areas will be exposed. Author (ESRO)

N71-18436*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE AVIONICS TECHNOLOGY
Jul. 1970 49 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970
(NASA-TM-X-66893) Avail: NTIS CSCL 22B

The requirements of space shuttle avionics, the range of system approach under investigation, and a summary of the technology and advanced development program being pursued, are described. ESRO

N71-18437*# National Aeronautics and Space Administration, Washington, D.C.
SPACE TRANSPORTATION SYSTEM OVERVIEW AND PROGRAM PLANS
Dale D. Myers 26 Jun. 1970 113 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970
(NASA-TM-X-66895) Avail: NTIS CSCL 22A

The space shuttle is considered to be the base element of future space transportation systems. Its potential uses include the placing or recovery of unmanned spacecraft in low or high orbits, the repair and servicing of satellites, the delivery of propulsion stages and payloads, short duration missions and general support to space stations. Alternative configurations for the shuttle propulsion systems, heat shield, and testing procedures are presented. ESRO

N71-18438*# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE SHUTTLE PROGRAM REVIEW
B. Hello, J. W. Sandford, and D. A. Dooley 1970 80 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970 Sponsored by NASA Prepared in cooperation

with General Dynamics/Convair
(NASA-CR-116600; SD-70-9) Avail: NTIS CSCL 22A

The essential features of the phase B shuttle program and some of the technical aspects of the baseline system are presented. Configurations and mission profiles for the shuttle orbiter and booster, subsystems and operations, and the development plan and testing program are the main items touched. ESRO

N71-18581*# McDonnell-Douglas Co., St. Louis, Mo.
AN OPPORTUNITY FOR INTERNATIONAL COOPERATION
1970 115 p Presented at the ELDO/NASA Space Transportation Systems Briefing, Bonn, 7–8 Jul. 1970
(POSS-618-670) Avail: Issuing Activity

A phase B configuration selection for the space shuttle describing possible vehicles and their flight characteristics is given. An outline is also given of structures, materials, and thermal protection systems, and principal subsystems as well as the approach for ensuring low cost, and critical development issues. ESRO

N71-18611* Bendix Corp., Detroit, Mich.
DEFORMABLE VEHICLE WHEEL Patent
Donald L. Dewhirst and Calvin V. Kern, inventors (to NASA) Issued 3 Feb. 1970 (Filed 20 May 1966) 6 p Cl. 152-11; Int. Cl. B60b9/00 Sponsored by NASA
(NASA-Case-MFS-20400; US-Patent-3,493,027; US-Patent-Appl-SN-551694) Avail: US Patent Office CSCL 22B

A deformable vehicle wheel capable of travel on lunar surfaces is described. The device has a flexible outer rim joined to a hub by resilient ring shaped members in such a manner that all ring members are resiliently deformable in the radial direction. This arrangement allows for relative radial movement between the rim and the hub and yet provides resistance to motion between rim and hub in axial direction. Official Gazette of the U.S. Patent Office

N71-18638*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHUTTLE SAFETY: SOME REPRESENTATIVE PROBLEMS
I. Irving Pinkel [1971] 17 p refs Presented at the Space Shuttle Develop. Testing and Operations Conf., Phoenix, 15–18 Mar. 1971; AIAA
(NASA-TM-X-52984) Avail: NTIS CSCL 22A

Novel safety problems are introduced by the hybrid rocket vehicle/airplane configuration, presently called the space shuttle, that relate to the durability required of its systems to serve 100 missions, the short service time between flights, its special engines, fuels and cargo. Outlined are some of the problems and their technical contents that cover maintenance of the shuttle and its flight readiness certification. Author

N71-18639# Hawker Siddeley Aviation, Ltd., London (England).
EUROPEAN SMALL SHUTTLE LINKED TO POST-APOLLO
R. H. Francis 1970 9 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

European-NASA cooperation in the post-Apollo program is discussed. A contribution to the test vehicle program of model flight experiments, giving information on the thermal environment and control problems of reentry is considered. The development of a small shuttle (2 1/2 stage system) and its European applications (short duration earth resource missions, astronomical laboratory etc.) are emphasized. ESRO

N71-18640# European Space Research Organization, Paris (France).
THE EUROPEAN PROGRAMME OF APPLICATION SATELLITES
H. Bondi 1970 23 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

Results of the fourth European Space Conference held in Brussels are given. Emphasis is placed on a European communications satellite program and on the technical characteristics of the space system capable of meeting the operational requirements of CEPT (European Conference of Postal and Telecommunications Administrations) and EBU (European Broadcasting Union). Technical data such as frequency range, satellite design, etc., are listed. The ESRO-NASA aeronautical satellite program for air traffic control purposes is reviewed and the mission objectives for a meteorological satellite program outlined. It was decided to perform several feasibility studies on other space applications such as direct and semi-direct television broadcasting, earth resources, and data relay satellite. ESRO

N71-18641# Technische Hochschule Munchen (West Germany). Inst. fuer Raumfahrttechnik.
A STUDY OF THE USE OF GUIDED SELF-LIFTING RE-ENTRY BODIES [STUDIE UEBER DIE NUETZLICHKEIT STEUERBARER AUFTRIEBSERZEUGENDER WIEDEREINTRITTSKOERPER]
Alwin Suess Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Sep. 1970 176 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-49) Avail: NTIS; ZLDI Munich: 36,55 DM

The operational advantages of aerodynamic reentry vehicles and of various landing modes are discussed in the light of technological difficulties, increased costs, and weight penalties. Payload return missions using reentry vehicles are compared with those using other methods. There appear to be no good reasons for developing these vehicles for unmanned and non-military missions. Possible technical advances and other uses are not considered. Author (ESRO)

N71-18648*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REFERENCE SYSTEM CHARACTERISTICS FOR MANNED STOPOVER MISSIONS TO MARS AND VENUS
Jerry M. Deerwester and Susan M. Norman Washington Mar. 1971 74 p refs
(NASA-TN-D-6226; A-3665) Avail: NTIS CSCL 22C

Trajectories, system elements, features of the natural environment, and overall performance requirements for manned stopover missions to Venus and Mars are reported. Use of the most recent interplanetary trajectory analyses provided a unified framework for comparing mission modes and launch opportunities. The scaling laws that define the spacecraft and propulsion systems and the space environment were established. The trajectory data and the scaling laws were combined and values were calculated for the required mass in Earth orbit for each of the missions under study. The requirements for a representative stopover mission to Venus and for stopover missions to Mars during every launch opportunity between 1980-2000 for the most attractive mission profiles are summarized. In addition, the flight times, mission dates, and velocity requirements are given. Finally, the scaling laws used in the calculations are discussed. These scaling laws define the space environment and the spacecraft propulsion systems. Author

N71-18649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP-1 LAUNCH WINDOW ANALYSIS
Bernard Kaufman and Daniel P. Muhonen Jan. 1971 42 p refs Submitted for publication

(NASA-TM-X-65450; X-551-71-5) Avail: NTIS CSCL 22D

The IMP-I is first inserted into a parking or preliminary orbit. This park orbit is circular and inclined about 28.3 degrees to the equator. After remaining in this orbit for exactly one-half period, the second state is reignited and later separated from the third stage which injects the satellite into the final highly eccentric orbit. Final injection occurs over the west coast of Australia with the apogee of the orbit occurring over the Northern Hemisphere. Author

N71-18725# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).

EXTENSIVE AIR SHOWERS

J. Truemper Sep. 1970 25 p refs Presented at the 6th Interam. Seminar on Cosmic Rays, La Paz, Bolivia, Jul. 1970

(MPI-PAE/Extraterr-47) Avail: NTIS

A review of the most recent results on extensive air showers is presented. The divergences of these results with the Lindenbaum asymptotia theory are considered and the existence of quarks, the large transverse momenta, and the primary energy spectrum in air showers is discussed. The chemical composition in the region where the spectrum grows steeper is discussed as well as some aspects of pulsar activity in the air shower energy range. ESRO

N71-18726*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif.

LAUNCH VEHICLE, VOLUME 2 ILRS-NASA Final Report, Mar. -Jul. 1969

22 Jun. 1969 191 p refs

(Contract NAS9-9204)

(NASA-CR-116802; H367-Vol-2) Avail: NTIS CSCL 22B

A low cost space transportation system is a requisite to more economical space exploration. Determined were (1) the potential economics of a reusable transportation system; and (2) the degree of reusability that would offer the most promising operational space transportation/logistics system. Emphasis was directed toward the selection and detailed analysis of the best low cost expendable launch vehicle. Some 32 launch vehicle concepts with low cost potential were sized to a minimum cost criterion and the five most promising were selected for further analysis. All five concepts used solid propulsion in the lower stages. Author

N71-18744*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

USE OF SPACE TUG TO INCREASE PAYLOAD CAPABILITY OF SPACE SHUTTLE

Edwin F. Harrison and E. Brian Pritchard Washington Feb. 1971 18 p refs

(NASA-TN-D-6241; L-7443) Avail: NTIS CSCL 22A

An analysis was performed to determine the increased payload capability of a space shuttle/space tug combination over that of the shuttle only. In this mode of operation, the space shuttle is assumed to transport the payload from the ground to a low orbit (185 km). At that point, the payload is transferred to a space-based tug which completes the trip to the space station (located in a 500-km orbit). An alternative mode considered was the use of an earth-based tug which is carried to and returned from orbit by the shuttle. It is shown that the payload capability of the shuttle can be increased by approximately 25 to 45 percent with the aid of either tug. The analysis also includes a study of the effect of variation in orbital inclination on payload capability for the two systems. The results indicated that the tug shuttle combination is much more efficient in delivering large payloads to highly inclined orbits and can deliver payloads to much higher altitudes than the shuttle system alone. Author

N71-18745*# General Electric Co., Schenectady, N.Y. Specialty Fluidics Operation.

STUDY OF FLUIDIC ROLL CONTROL FOR SOUNDING ROCKET APPLICATIONS

Carl G. Ringwall and William L. Keltz Aug. 1970 41 p ref

(Contract NAS2-5467)

(NASA-CR-73499) Avail: NTIS CSCL 22B

The optimum fluidic implementation of roll control loops for a typical Solar Pointing Aerobee Rocket Control System was investigated. The system utilizes a fluidic proportional thruster (FPT) to modulate the roll, pitch, and yaw thrusters. Each of the loops (despin, roll rate, and roll position) is initiated with a solenoid valve which applies fluid power to the control loop. The despin loop drives despin nozzles while the roll rate and roll position loops operate the FPT which in turn operates the roll thrust nozzles. A single vortex rate sensor is utilized first for the despin loop and later for the roll rate loop during coarse acquisition. Vent flow from the despin control is collected and utilized in the despin nozzles, and provision is made for collecting the vent flow from the fluidic roll rate and roll position control loops. The gas is collected and exhausted through the vortex valves in the FPT to prevent generation of random thrusts. Author

N71-19243*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

ACCEPTANCE CHECKOUT EQUIPMENT FOR SPACECRAFT

Walter E. Parsons 26 Jan. 1971 30 p refs

(NASA-TM-X-66890; KSC-TR-1091) Avail: NTIS CSCL 22D

The design requirements and development of the acceptance checkout equipment for spacecraft are discussed. The concept of man in a system, the man-machine relationship, and the application of reliability predictive techniques are discussed. Man, the analyzer/decision-maker, is the monitor in a computer-controlled, electronic checkout system for spacecraft. Author

N71-19244*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

RELIABILITY AND QUALITY ASSURANCE GUIDELINE FOR GOVERNMENT-FURNISHED EQUIPMENT CONTROL

Feb. 1971 10 p

(NASA-TM-X-66889; MSC-03613) Avail: NTIS CSCL 22D

Guidelines to recipients of government furnished equipment in the preparation of internal control programs are presented. Equipment is identified and classified as: (1) Class 1 – acceptable for use in flight, (2) Class 2 – unacceptable for flight, but may be used for ground testing or training in a hazardous environment, and (3) Class 3 – unacceptable for flight or use in a hazardous environment, but may be used for nonhazardous training or display purposes. Author

N71-19245*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

OPTIMUM PRESSURE VESSEL DESIGN BASED ON FRACTURE MECHANICS AND RELIABILITY CRITERIA

Ewald Heer and Jann-Nan Yang 1 Feb. 1970 40 p refs

(Contract NAS7-100)

(NASA-CR-116827; JPL-TM-33-470) Avail: NTIS CSCL 22B

Spacecraft structural systems and subsystems are subjected to a number of qualification tests in which the proof loads are chosen at some level above the simulated loads expected during the space mission. Assuming fracture as prime failure mechanism, and allowing for time effects due to cyclic and sustained loadings, an optimization method is presented in which the statistical variability of loads and material properties are taken into account, and in which the proof load level is used as an additional design variable. In the optimization process, the structural weight is the objective function while the total expected cost due to coupon testing for

material characterization, due to failure during proof testing, and due to mission degradation is a constraint. Numerical results indicate that for a given expected cost constraint, substantial weight savings and improvements of reliability can be realized by proof testing. Author

N71-19270*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMICS OF A MODEL OF THE HL-10 FLIGHT-TEST VEHICLE AT MACH 0.35 TO 1.80
Charles L. Ladson and Acquilla S. Hill Washington Feb. 1971 131 p refs
(NASA-TN-D-6018; L-7265) Avail: NTIS CSCL 22A

A summary is presented of tests conducted to determine the aerodynamic characteristics of a model of the HL-10 lifting-body flight vehicle at speeds from low subsonic through a Mach number of 1.80. Data throughout this speed range are given for the trimmed longitudinal, directional and lateral stability, and lateral control characteristics. Detailed results at Mach 1.50 and 1.80 are also presented. Author

N71-19278# California Univ., Livermore. Lawrence Radiation Lab.
DEPLOYMENT HANDBOOK FOR THE CLEANSWEEP 3B ROCKET SAMPLING SYSTEM
Richard T. Williams 3 Feb. 1969 141 p refs
(UCRL-50586) Avail: NTIS

The Cleansweep IIIB rocket system was developed to provide a nuclear cloud debris sampling capability for early sampling of regions of nuclear clouds unattainable by other means. It provides isokinetic collection to about 120,000-ft (MSL) altitude on full weight IPC 1478 filter paper and can reach altitudes in excess of 150,000 ft. Cleansweep IIIB is the only known operational atmospheric sampling rocket system. Author (NSA)

N71-19310* National Aeronautics and Space Administration, Washington, D.C.
LAUNCH VEHICLE ESTIMATING FACTORS FOR USE IN ADVANCE SPACE MISSION PLANNING
Jan. 1971 222 p refs
(NHB-7100.5) Avail: NASA Headquarters, Washington, D.C. Attn: DHA-7 CSCL 22B

A tool for establishing a first estimate of launch vehicle requirements in the preparation of advance mission plans is presented. The document is organized so that the user, having defined a mission in terms of payload weight and orbital specifications or space destination, may normally proceed through the following steps: (1) Determination of basic mission velocity requirements, from mission factors and conversion charts; (2) Determination of launch site effects and incremental correction on velocity requirements as a function of orbit inclination or launch azimuth at each site, from launch site factors; (3) Determination of the total characteristic velocity required to accomplish the mission, through combination of the results of (1) and (2); and (4) Determination of the launch vehicle(s) that can deliver the prescribed payload weight at the required characteristic velocity from a specified launch site, from generalized performance data for expendable launch vehicles using chemical propulsion, space shuttle performance. This procedure is appropriate for most launch vehicles; however, because of various constraints, performance capabilities of certain vehicles cannot be generalized. This is particularly true for Earth orbital missions. Therefore, specific Earth orbital performance data for selected expendable launch vehicles and for the space shuttle without upper stages are also included. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-18315# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
STEADY STATE CREEP TEST OF NOZZLE/SPHERICAL SHELL INTERSECTIONS. PART 1: TEST RIG AND INSTRUMENTATION
E. Procter and J. T. Strong May 1970 21 p refs Submitted for publication
(RD/B/N-1668) Avail: AEC Depository Libraries

The experimental techniques used to complete a steady-state creep test on a model pressure vessel containing four nozzles in a spherical cap are described. This is the third and final test in an experimental research program designed to investigate the behavior of nozzle/spherical shell intersections. The model pressure vessel was subjected to an internal pressure of 485 psig and a temperature of 430 C for 3000 hr, and the accumulation of creep strain in the shell plate and local to the nozzles was measured. The heating, pressurization, control equipment, and the methods of strain measurement are discussed. Author (NSA)

N71-18316# Texas Univ., Austin. Center for Highway Research.
A METHOD OF ESTIMATING TENSILE PROPERTIES OF MATERIALS TESTED IN INDIRECT TENSION
William O. Hadley, W. Ronald Hudson, and Thomas W. Kennedy Jul. 1970 59 p refs Sponsored by Tex. Highway Dept. and Dept. of Transportation
(PB-195334; RR-98-7) Avail: NTIS CSCL 13B

Equations were developed for estimating values of modulus of elasticity, Poisson's ratio, and tensile failure strains for circular specimens based upon total horizontal and vertical deformations created in the specimen during indirect tensile testing. To substantiate the equations, a circular aluminum specimen, which is considered to exhibit a high degree of elasticity, was tested in indirect tension. The aluminum specimen was instrumented with rosette strain gages at the center. The results indicated that the elastic properties can be obtained from total horizontal and vertical deformations of an elastic material tested in indirect tension. Additional tests were conducted to evaluate the effect of the dimensions of the curved loading strip used in the indirect tensile test and to evaluate the effect of loading rate (vertical strain rate). Author (GRA)

N71-18388# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plants Div.
RESIDUAL STRESSES IN LARGE SIZE WELDED STRUCTURES
I. Kupka 1970 12 p refs
(ZJE-87) Avail: AEC Depository Libraries

The principle of measurement of residual stresses on large parts of a general shape is presented. On an example quoted for the determination of residual surface as well as internal stresses, the importance of knowledge of the magnitude and distribution of stresses in large welded structures is pointed out. Author (NSA)

N71-18460# Mons Univ. (Belgium). Materials Resistance Lab.
PLASTIC AND RUPTURE BEHAVIOR OF FLAT-BOTTOMED CYLINDRICAL PRESSURE VESSELS [COMPORTEMENT

PLASTIQUE ET A LA RUPTURE DES RESERVOIRS CYLINDRIQUES A FONDS PLATS]
Marcel Save and Marek Janas (Polish Acad. of Sci.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Aug. 1970 91 p refs Sponsored by IRSIA
(CRIF-MT-58) Avail: NTIS

The mechanisms of plastic deformation and rupture of steel cylindrical pressure vessels and their effect on the thickness necessary for safe operation are analyzed. It is found that the thickness of the heads can be limited in favor of the thickness of the walls without risking a rupture every time the rated pressure is not reached. ESRO

N71-18522# Auburn Univ., Ala. Dept. of Mechanical Engineering.
STUDY OF THE ONSET OF PERMANENT DEFORMATION IN STRUCTURALLY BONDED JOINTS Final Report
Wartan A. Jemian Nov. 1970 99 p refs
(Contract DA-01-021-AMC-12832(Z))
(AD-715712) Avail: NTIS CSCL 13/5

Deformation mechanics of structurally bonded joints and coated metallic single crystals was studied from both the phenomenological and mechanistic points-of-view. The polymer coating was observed to allow the normal initiation of slip but slip was limited on each plane by the stretched polymer. This accounts for a coating effect comparable in magnitude to those of some metallic and ceramic coatings. A pronounced polymer stiffening was observed after a critical amount of strain in both coated single crystal samples and bonded lap-shear and symmetrical double-lap joint configurations prior to crack nucleation. A separate stress analysis showed that the surface of the joint at the loading edge and at the tip of a crack along the overlap is subjected to tearing stresses only. A fracture toughness test method using lap-shear samples was developed to determine the fracture toughness by the strain energy release rate method in the opening mode. The results confirm those reported from studies on a similar system but in a different sample configuration. Author (GRA)

N71-18588# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section de Construction Metallique.
EXPERIMENTAL STUDY OF INDUSTRIAL PROBLEMS. STRESS MEASUREMENTS ON A THIN-WALLED LARGE PRESSURE VESSEL
Rudy Beeckman, Joris Decock, and Arnold Sys Dec. 1970 34 p refs Sponsored by IRSIA Prepared jointly with Ghent Univ.
(CRIF-MT-67) Copyright. Avail: NTIS

Stress measurements on a thin-walled pressure vessel with a diameter of 7650 mm and a total length of 75,000 mm have been carried out. The deformations during a hydraulic test were measured by 120 strain gages, in order to evaluate the stresses in different cross sections of the cylinder and the stress distribution around a manhole. Supplementary measurements were carried out at several nozzles and attachments of the pressure vessel. Due to the large dimensions of the construction, a certain scale effect could be expected, if such an effect exists. However, the measured hoop stresses were in agreement with the nominal value, and comparison of the stresses at the nozzles with stress results of much smaller vessels showed no appreciable differences. Author (ESRO)

N71-18590# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section de Construction Metallique.
STUDY OF ALUMINUM ALLOY WELDING AND MECHANICAL CHARACTERISTICS OF WELDED JOINTS HAVING POROSITIES [ETUDE DU SOUDAGE DES ALLIAGES D'ALUMINIUM ET CARACTERISTIQUES MECANIQUES DES JOINTS SOUDES PRESENTANT DES SOUFFLURES]
Jean Martelee Jun. 1970 82 p refs In FRENCH Sponsored in part by IRSIA and Fondation Nucl.
(CRIF-MT-54) Avail ntis

Perfectly compact welded joints on 99.5% aluminum and Al Mg3 alloys with porosity defects do not noticeably reduce their mechanical properties provided they have not been levelled. If levelling has taken place the surface may present defects which can initiate cracks. Rupture tests under pneumatic pressure indicated no brittle rupture under low stress and no breaking up. ESRO

N71-18591# Ghent Univ. (Belgium). Lab. of Material Resistance.
A SIMPLIFIED DESIGN OF HORIZONTAL VESSELS ON TWO SADDLE SUPPORTS
Rudy Beeckman, Joris Decock, and Arnold Sys Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Sep. 1970 29 p refs Sponsored by IRSIA
(CRIF-MT-61) Avail: NTIS

The calculation method for the design of saddle supports for horizontal vessels has been simplified to allow an immediate calculation of the minimum required shell thickness to sustain the weight of the vessel and its content. Strain gage measurements on existing storage tanks give reason to question the validity of some of the used formulas. Author (ESRO)

N71-18612# Tokyo Univ. (Japan). Inst. of Industrial Science.
PLASTIC BUCKLING AND POST-BUCKLING BEHAVIORS OF STEEL PLATES
Koichi Takanashi Oct. 1970 37 p refs *Its* Serial No. 129, v. 20, n. 4
Avail: NTIS

A general theory of uniqueness and stability for rectangular plates is developed. Plastic buckling loads of rectangular plates under various boundary conditions are calculated as an example. It is well known that unavoidable initial imperfections in geometry reduce considerably the plastic buckling loads of plates obtained theoretically. In order to make this evidence and the post-buckling behaviors more clear, equilibrium equations of rectangular plates under each given increment and end loads were solved step-wise. Finally, buckling tests of steel plates were carried out. These tests show that there is a good correlation between the theory and the test results. Author

N71-18619*# Translation Consultants, Ltd., Arlington, Va.
CALCULATION OF MINIMUM-WEIGHT BEAMS AND FRAMES UNDER RANDOM LOADING [RASCHET BALOK I RAM NAIMENSHEGO VESA PRI SLUCHAYNOM ZAGRUZHENII]
A. M. Araslanov Washington NASA Feb. 1971 11 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Prikl. Mekhan. (Kazan), no. 105, 1969 p 41-48
(Contract NASw-2038)
(NASA-TT-F-13451) Avail: NTIS CSCL 20K

Development of a method for calculating minimum weight beams and frames with allowance for the probabilistic nature of the load and the bearing capacity of the material is considered. The minimum weight equations of the problem are derived, which, together with the equations of continuity of strains, satisfy the strain compatibility conditions. Author

N71-18620*# Translation Consultants, Ltd., Arlington, Va.
CALCULATION OF UNIFORMLY DEPENDABLE MINIMUM-WEIGHT STRUCTURES [K RASCHETU RAVNONADEZHYKH KONSTRUKTISY NAIMENSHEGO VESA]

A. M. Araslanov Washington BASA Feb. 1971 9 p refs transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Prikl. Mekhan. (Kazan), no. 105, 1969 p 78–84
(Contract NASw-2038)
(NASA-TT-F-13450) Avail: NTIS CSCL 20K

Development of a simplified method of calculating minimum-weight beams and frames under random loads in the form of a random vector function is reported. A method initially proposed in which the problem was solved in matrix form by successive approximations on a computer is simplified by eliminating the need to use successive approximations. By substituting a one-degree-of-freedom system for a given structure, an engineering solution is obtained in closed form. Author

N71-18642# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CREEP DEFORMATION OF A CYLINDER UNDER COMPLEX VARYING LOADING [DEFORMATION EN FLUAGE D'UN CYLINDRE SOUMIS A DES CHARGES COMPLEXES ET VARIABLES]
Jean Lemaitre 1970 28 p refs In ENGLISH and FRENCH Presented at the 2nd IUTAM Symp. on Creep in Struct., Goteborg, 17–21 Aug. 1970 Submitted for publication
(ONERA-TP-846) Avail: NTIS

In order to calculate static or dynamic creep deformations of complex structures under realistic loading, a theory of elasto-visco-plasticity must be established in the three dimensional case of a nonsteady state of stress and nonsteady temperature field. A generalization of Odquist and Hoff's law has been developed and its application to the calculation of deformations of a cylinder is made by means of a step-by-step in-time method. The load programs in tension, torsion, and internal pressure include large variations in time of loads and temperature (increase or decrease) in order to check the validity of the law in the general case. The corresponding experiments were performed and the comparison between theoretical results and test results shows a good agreement for the purpose of structure calculations. Author (ESRO)

N71-18643# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugzeugbau.
BUCKLING AND POSTBUCKLING OF ECCENTRICALLY STIFFENED THIN-WALLED CIRCULAR CYLINDERS SUBJECTED TO AXISYMMETRIC LOADS [BEULEN UND NACHBEULEN EXZENTRISCH VERSTEIFTER DUENNWANDIGER KREISZYLINDER UNTER AXIALSYMMETRISCHER BELASTUNG]
Maria Esslinger Sep. 1970 41 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-48) Avail: NTIS; ZLDI Munich: 11 DM

A method for calculating load shortening curves is applied to stringer stiffened axially loaded cylinders. Theoretical and experimental results are in good agreement. Author (ESRO)

N71-18644# Louvain Univ. (Belgium). Inst. of Mechanical Manufacturing.
NEW FORMULAS IMPROVE E-MODULUS CALCULATIONS. DISC-SHAPED BODIES AND RECTANGULAR OR SQUARE BARS
Albert Decneut (Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal.) Brussels Centre de Rech. Sci. et Tech. de l'Ind. des Fabric. Metal. Nov. 1970 34 p refs Sponsored by IRSIA
(CRIF-MC-37) Copyright. Avail: NTIS

Simple formulas have been developed for calculating the modulus of elasticity of thin circular plates and perforated disks. Experiments have been performed on a large number of bodies of widely differing shapes to extend the range of validity of previous works. The results showed the cross influence between hole size and disk thickness. A mathematical treatment of experimental data using a multiple regression technique allowed the computation of a shape factor for hole-to-diameter ratio ranging from 0.0 to 0.8 and for thickness-to-diameter ratio up to 30%. ESRO

N71-18645# Midwest Research Inst., Kansas City, Mo.
STRAIN DISTRIBUTION AND DEFORMATION AT THE CRACK TIP IN LOW CYCLE FATIGUE Final Technical Report, 2 Apr. 1969–1 Apr. 1970
C. Q. Bowles Jun. 1970 72 p refs
(Contract DAAG-46-69-C-0077)
(AD-715421; AMMRC-CR-70-23) Avail: NTIS CSCL 20/11

The behavior of the material in the tip region of fatigue cracks in 1100-F Al and 4340-A6 steel was studied. The size of the plastic zone which accompanies the crack and the extent of the strain field which is associated with that plastic zone were observed by chemical etching techniques. As part of the experimental program, a technique was developed for making a cast replica of the fatigue crack by in situ infiltration with plastic. These castings were studied by scanning electron microscopy. Author (GRA)

N71-18646*# Translation Consultants, Ltd., Arlington, Va.
THE USE OF VARIATIONAL METHODS IN CALCULATING MEDIUM-WEIGHT SYSTEMS [PRIMENENIYE VARIATSIONNYKH METODOV K RASCHETU SISTEM NAIMENSHEGO VESA]
S. Kh. Gaynullina Washington NASA Feb. 1971 12 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Stroit. Mekhan. (Kazan), no. 91, 1966 p 66–77
(Contract NASw-2038)
(NASA-TT-F-13452) Avail: NTIS CSCL 20K

The calculations of statically determinable and statically indeterminable minimum weight beams with given displacements under constant or transient loads are reported. The problem is formulated as one of determining the beam area which minimizes the functional beam volume. This problem is solved by reducing it to the isoperimetric problem of determining a beam area function which minimizes the functional beam volume in the presence of isoperimetric couplings. Author

N71-18647*# Oklahoma Univ., Norman. School of Aerospace and Mechanical Engineering.
THE INFLUENCE OF CHANGING END CONDITIONS ON THE RESONANT RESPONSE OF BEAMS AND PLATES
D. M. Egle Washington NASA Mar. 1971 65 p refs
(Grant NGR-37-003-041)
(NASA-CR-1736) Avail: NTIS CSCL 20K

In the dynamic testing of structures, it is sometimes necessary to conduct response tests of a substructure while it is separated from the parent structure. The effects of changing end conditions on the maximum resonant responses of a free-elastically supported beam excited by a spatially uniform load, and a plate, pinned on three edges and elastically supported on the fourth, excited by a concentrated force are investigated. It is demonstrated that it is possible to estimate maximum resonant response for a wide range of elastic edge restraints by employing a single term principal mode approximation. Author

N71-18738*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
ON THE INTERACTION FORCES AND RESPONSES OF STRUCTURAL RINGS SUBJECTED TO FRAGMENT IMPACT Interim Technical Report, 1 Aug. 1969–31 Jul. 1970

R. Bruce McCallum, John W. Leech, and Emmett A. Witmer Sep. 1970 191 p refs
(Grant NGR-22-009-339)
(NASA-CR-72801; ASRL-TR-154-2) Avail: NTIS CSCL 20K

A FORTRAN 4 computer program, JET 2, is presented for prediction the large two dimensional, elastic-plastic, dynamic Kirchhoff deformations of an isothermal circular ring subjected to an initial impulse loading. Strain-hardening and strain-rate effects of the ring material are taken into account. A method using measured ring position vs. time data to calculate the transient interaction forces resulting from a containment ring-fragment interaction was enlarged and improved. Force vs. time results employing data from two tests involving single-blade impact upon a circular metal ring are presented. Author

N71-18810# Florida Univ., Gainesville. Dept. of Engineering Science and Mechanics.
NUMERICAL ANALYSIS OF PLANE ELASTIC-PLASTIC BOUNDARY VALUE PROBLEMS: THEORY AND APPLICATION TO SINGLE CRYSTAL BEAM
Martin A. Eisenberg and Byoung Sung Kim Dec. 1970 71 p refs
(Contract N00014-68-A-0173-0002)
(AD-715778; TR-5) Avail: NTIS CSCL 20/11

A technique for the solution of a large class of plane elastic-plastic problems is presented and applied to the bending of a simply supported single crystal beam. The solution of elastic-perfectly plastic problems is accomplished by means of an iterative scheme for the location of the elastic-plastic interface at given load levels. This necessitates the solution of the plane elasticity problem in domains with irregular boundaries and numerical methods are thus dictated. An appropriate finite difference method and computer code are described. This method and code can be readily extended to include effects of elastic anisotropy and non-homogeneity. Author (GRA)

N71-18884# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
INFLUENCE OF PRECATASTROPHIC EXTENSION AND OTHER EFFECTS ON LOCAL STRESSES IN CRACKED PLATES UNDER BENDING FIELDS
Dallas G. Smith (Tenn. Technol. Univ.) and C. W. Smith Nov. 1970 34 p refs
(Contract DAAF07-69-C-044; Proj. Themis)
(AD-715420; VPI-F-70-19) Avail: NTIS CSCL 20/11

Using the technique of stress freezing and slicing, a set of photo-elastic experiments was conducted on plates, each containing a single through internal crack in a remote cylindrical bending field, where each crack suffered precatastrophic extension on the tensile side of the plate as well as closure on the compression side. Resulting stresses were compared with the Sih-Hartranft Theory. Results indicate substantial stress relaxation near the tensile side of the plate due to precatastrophic extension. It is concluded that: (1) The Sih-Hartranft Theory may be used to estimate local elastic stresses on the tensile side of the plate even when closure and precatastrophic extension occur, (2) Complex coupling of closure and precatastrophic extension effects preclude the use of simple correction factors for existing mathematical models except for relatively small precatastrophic extension. Author (GRA)

N71-18923# Naval Civic Engineering Lab., Port Hueneme, Calif.
THE SPHERICAL ACRYLIC PRESSURE HULL FOR HYDROSPACE APPLICATION. PART 2: EXPERIMENTAL STRESS EVALUATION OF PROTOTYPE NEMO CAPSULE
J. D. Stachiw and K. L. Mack Oct. 1970 75 p refs
(AD-715772; NCEL-TN-1113-Pt-2) Avail: NTIS CSCL 13/10

The prototype 66-inch diameter spherical hull of NEMO with 2.5 inch wall thickness has been subjected to a series of hydrostatic tests under simulated hydrospace environment to determine its structural integrity. After repeated long term and cyclic tests in the 220 to 2400 foot depth range, the hull was tested to implosion at 4150 feet. The magnitude of strains measured on the hull during cyclic and long term loadings, as well as the short term implosion depth of 4150 feet indicate that the hull satisfies the 1000 foot design depth requirement and can be without any further tests incorporated into any man-rated system approved for operation in the 0 to 600 foot depth range. Author (GRA)

N71-18994*# Wyle Labs., Inc., El Segundo, Calif.
INVESTIGATION OF THE POSSIBLE STRUCTURAL OVER-TEST DUE TO THE QUALIFICATION OF SPACECRAFT STRUCTURES IN A REVERBERANT ROOM
V. Mason Jan. 1971 29 p refs
(Contract NAS9-10423)
(NASA-CR-114877; WR-71-1) Avail: NTIS CSCL 20K

The possible magnitude of the structural over-test received by a spacecraft structure which is qualified in a reverberant room is examined. It is assumed that the broadband excitation levels in the reverberant room are the same as those in the actual in-service environment. The results from one critical analysis have indicated the over-test might be larger. A reverberant sound field is composed of a multitude of resonant acoustic standing waves whereas the actual environment will be essentially non-resonant with a smooth excitation spectrum. The problem was approached by using a simple model of a structure in a reverberant room. This showed that when the coupling between the reverberant sound field and the structure was small, the structural response could be obtained, to a first approximation, by the product of the magnitude of the acoustic excitation spectrum and the magnitude of the structural response function without reference to phase angle. From this, a basis for an over-test was established. The magnitude of the over-test was found to depend on the band width used to analyze the structural response. Expressions for the magnitude of the over-test were obtained. It was shown that an over-test could be produced in a reverberant acoustic test but that its magnitude was not sufficient to account for the reported large discrepancy between vibro-acoustic response for reverberant tests and in-service environments. Author

N71-19101# Naval Civil Engineering Lab., Port Hueneme, Calif.
THE SPHERICAL ACRYLIC PRESSURE HULL FOR HYDROSPACE APPLICATION. PART 4: CYCLIC FATIGUE OF NEMO CAPSULE NUMBER 3
J. D. Stachin Oct. 1970 43 p refs
(AD-715345; NCEL-TN-1134-Pt-4) Avail: NTIS CSCL 13/10

The 66-inch outside diameter 2.5-inch thick NEMO Model 600 spherical hull 63 was hydrostatically pressure cycled till fatigue cracks appeared in the acrylic plastic and the top hatch plastically buckled. The plastic buckling of the hatch, fabricated from annealed 4130 alloy steel, took place during simulated repeated dives in the 2080 to 2250 foot depth range. The cracks in the acrylic plastic hull were located in the beveled surface in contact with the metallic polar closures. The cyclic tests conclusively prove that (1) an adequate cyclic fatigue safety factor exists for NEMO hulls performing, routinely, extended manned dives to 600-foot depth, and that (2) manned proof dives of 1 hour duration to 1200-foot depth can be performed providing the total number of proof test dives does not exceed 100. To prevent plastic buckling of the polar steel closures prior to general implosion of the capsule it is necessary to specify heat treated 4130 steel alloy for the polar penetration closures. Author (GRA)

N71-19140 Lehigh Univ., Bethlehem, Pa.
DEFORMABILITY OF FIBER REINFORCED MATERIAL AND THE EFFECT OF PLASTIC DEFORMATION ON ITS MECHANICAL PROPERTIES

Boaz Avitzur (Ph.D. Thesis) 1969 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 70-1713

The material of interest is aluminum reinforced by 10 Vol.% of Al3Ni fibers of 0.7 to 0.8 micron diameter. The composite was produced by unidirectional solidification. The plastic deformation was performed by hydrostatic extrusion into a receiver pressure. The effect of environmental pressure in inducing sound flow in otherwise brittle fibrous material is presented analytically in a quantitative manner. When 50% reduction in area was introduced by extruding into a receiver pressure of at least 150,000 psi, a sound product resulted, as anticipated from previous work. The micrographs indicate that the voids formed by fracture of the fibers were healed by flow of the aluminum matrix. For the evaluation of the tensile test results, a strength equation for fibrous materials was introduced. This equation was developed by the upper bound approach and it predicts both the strength of the composite and whether the fibers will fracture. Dissert. Abstr.

N71-19141 Lehigh Univ., Bethlehem, Pa.
FRACTURE TRANSITION PHENOMENA
James Andrew Begley (Ph.D. Thesis) 1969 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-1714

Macroscopic fracture transition phenomena, in terms of (1) a transition from plane strain to plane stress fracture, and (2) a transition from small to large scale yielding prior to fracture were investigated using a fracture mechanics approach. The effects of variations and combinations of crack size, thickness, and temperature on fracture transitions in 7075-T651 aluminum were studied. It was found that the observed transition phenomena were readily understandable in terms of fracture mechanics concepts. Furthermore, transition conditions permitting the observation of the two types of transitions were quantitatively predicted from fracture mechanics data. An analysis based on R curves was helpful in this respect. One of the conclusions was that ductile to brittle transitions will occur in some alloys independently of a microscopic fracture mode transition. In many cases transitions of this type will be quantitatively predictable from fracture mechanics parameters. Dissert. Abstr.

N71-19142 Lehigh Univ., Bethlehem, Pa.
SOME ASPECTS OF THE STUDY OF RANDOM PROCESSES WITH REGARD TO FATIGUE
Walter R. Henkel (Ph.D. Thesis) 1969 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 70-1726

The problem is considered of obtaining the rise and fall statistics of the plastic strain of an elastic-perfectly plastic material subjected to random loading. By use of a Monte-Carlo method, the effects of important parameters are isolated and related to rise and fall probabilities. Studies are made of the degree of approximation entailed in neglecting the dependence of rises and falls on past occurrences. This leads to a proposal for the direct characterization of rises and falls as n sup th order Markov chains. The method is illustrated using data samples from a particular random process by computing the return from several history dependent measure-functions, for various values of n, and comparing with the true return. Tables of frequency counts from which independent and first order conditional probabilities of rise and fall in plastic strain may be readily estimated are presented for idealized random processes obtained by varying the bandwidth and the root-mean-square independently. Dissert. Abstr.

N71-19143 Yale Univ., New Haven, Conn.
YIELD SURFACES AT ELEVATED TEMPERATURES
Kenneth Chih-Shen Liu (Ph.D. Thesis) 1969 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 70-2764

The initial yield surface and two subsequent yield surfaces due to torsional strain-hardening at several elevated temperatures were studied. An existing combined tension-torsion deadload type machine was adopted for testing at elevated temperature for commercially pure aluminum 1100. Instead of obtaining yield surfaces in the two-dimensional stress space (tension stress vs. torsional shear stress) with the temperature as a parameter, the yield surfaces are represented in the stress-temperature space. The yield surfaces in the stress-temperature space are determined by an isothermal-mechanical loading method and a non-isothermal loading method. The isothermal method was used first to plot the yield locus at several isothermal planes in the stress-temperature space. The non-isothermal loading method was then applied to verify the results of the earlier findings. Dissert. Abstr.

N71-19151*# Scientific Translation Service, Santa Barbara, Calif.
YOUNG'S MODULUS, SHEAR MODULUS AND COMPRESSIBILITY OF FeNi (FCC) ALLOYS [Fe-Ni (fcc) KEI-GOKIN NO YANGUDANSEIRITSU, ZURE-DANSEIRITSU OYOBI ASSHUKURITSU]
Yasunori Tanji et al Washington NASA Mar. 1971 11 p refs Transl. into ENGLISH from Nippon Kinzoku Gakkaishi (Sendai City), v. 34, no. 4, 1970 p 417/421
(Contract NASw-2035)
(NASA-TT-F-13479) Avail: NTIS CSCL 20K

The flexural and torsional resonance frequencies were measured with an electrostatic driving method in vacuum and a magnetic field of H = 1200 Oe for the same specimens of Fe-Ni (fcc) alloys. The results are: (1) Young's modulus, shear modulus and compressibility in a paramagnetic state, E sub p, G sub p, and K sub P, were separated from the experimental values in a ferromagnetic state, respectively, E sub p, G sub p, and K sub p show anomalies: The former two show a maximum and the latter a minimum in the Invar region. (2) In the Invar region, the temperature coefficient of Young's modulus becomes the highest and the thermal expansion coefficient the lowest. (3) The Elinvar property appears at 44% Ni. Author

N71-19160*# New York Univ., N.Y. School of Engineering and Science.
STRUCTURAL THEORY FOR AXIALLY SYMMETRIC CIRCULAR CYLINDERS
Robert F. Melworm, Irwin Berman (Foster Wheeler Corp.), and Bernard W. Shaffer Sep. 1970 37 p refs
(Grant NGL-33-016-067)
(NASA-CR-16857; S-70-8) Avail: NTIS CSCL 20K

An elastic shell theory is formulated for axisymmetric circular cylinders by consistent application of the assumptions of classical structural theory. In formulating the theory, the ratio of the cylinder's wall thickness to its mean radius is not neglected in comparison to unity, and cognizance is taken of the actual surfaces on which loads are applied. The resulting set of equations is reduced, by consistently neglecting certain powers of the thickness to mean radius ratio as compared to unity, to other governing sets of equations. Three such reductions are considered, the final one being an extended form of the commonly used thin-shell theory. Author

N71-19161 Stanford Univ., Calif.
CONTRIBUTIONS TO THE GLIDE RECOVERY MODEL FOR STEADY STATE CREEP
William Armitage Coghlan (Ph.D. Thesis) 1969 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-1510

Aspects of dislocation glide at high temperatures are studied in a two-part investigation. First, the velocity of screw dislocations limited by the non-conservative motion of jogs is investigated theoretically. Second, an indirect experimental measurement of the

temperature and effective stress dependence of the glide velocity of dislocations in lithium fluoride single crystals is conducted. Dissert. Abstr.

N71-19162# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF CONICAL SHELLS UNDER DYNAMICAL LONGITUDINAL COMPRESSION
M. A. Shumik 1971 4 p refs Transl. into ENGLISH from Prikl. Mekh. (Ukranian SSR), v. 6, no. 11, 1971 p 122–126
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of conical shell stability is solved in a geometrically linear formulation. It is assumed that the shell has initial imperfections characterized by normal deflection. The expression for the initial shape deflection agrees with the expression for additional deflection which originates because of loading application. Inertial loadings corresponding to a displacement in the direction of the normal to the surface are taken into account. The stresses in the middle surface are considered to be applied instantaneously, and therefore, the process of elastic wave propagation is not considered. The fundamental stress state is assumed to be a membrane and inertialess state. It is concluded that under intensive loading there is an upper bound for the impulse of critical compressive stresses in the same sense as for the stress under static loads. Author

N71-19173 Rensselaer Polytechnic Inst., Troy, N.Y.
FATIGUE MECHANISMS IN THE FRACTURE OF GLASSLIKE POLYMERS
Francis R. Martin (Ph.D. Thesis) 1969 131 p
Avail: Univ. Microfilm: HC $6.40/Microfilm $3.00 Order No. 70-2629

Crack growth in edge-cracked, plate specimens of PMMA under static and sinusoidal loading was studied at various temperatures, frequencies of loading, and relative magnitudes of static and sinusoidal loading. The crack growth per cycle can be described by f dc/dn = A exp (a K sub max), where f is the frequency, dc/dn is the crack extension per cycle, K sub max is the maximum stress intensity, and A and a are constants under a given set of loading conditions. The dependence of the parameters A and a on temperature and frequency strongly suggest that viscoelastic processes are important in crack growth in PMMA. A theory based on the failure of polymer chain bonds, and including the possibility of viscoelastic effects, is shown to be consistent with the observed crack growth behavior. Dissert. Abstr.

N71-19174 Connecticut Univ., Storrs.
INVESTIGATION OF THE BUCKLING STRENGTH OF FIBER GLASS REINFORCED PLASTIC BARS
Robert William Fitzgerald (Ph.D. Thesis) 1969 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-1256

After initial development of testing techniques on steel bars, 435 fiber glass reinforced plastic bars were tested as axially loaded columns. The purpose was to investigate the influence of the effect of variations in the length, thickness, and angle of orientation of load to warp direction of the laminate on the buckling strength of rectangular bars. Standard compression specimens were tested to obtain the stress-strain diagrams for the twelve subgroups of columns. The slope of the appropriate compressive stress-strain curve at the column buckling stress considered was taken as the modulus of elasticity in all analyses. The results indicate that, for the types of columns considered, the theoretical buckling formulas (Euler for the elastic cases and Engesser for inelastic cases) underestimate the experimental buckling strength of a column. Dissert. Abstr.

N71-19175 Rensselaer Polytechnic Inst., Troy, N.Y.
A DYNAMIC THEORY OF FLEXURE FOR PLATES INCLUDING THE EFFECTS OF TRANSVERSE SHEAR DEFORMATION AND NORMAL STRESS
Gerald Francis Lauterbach (Ph.D. Thesis) 1969 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 70-2626

An approximate theory is developed for the flexure of elastic plates of constant thickness. The theory is applied to simple thickness modes of vibration in an infinite plate and good agreement is obtained with exact theory for the first antisymmetric modes of thickness-shear and thickness-stretch. The theory is further applied to the propagation of straight-crested waves in an infinite plate. A corrected theory is derived in which only the first term in the lateral displacement expansions is used with the first and second terms in the normal displacement expansion. The corrected theory is applied to the axisymmetric motion of a solid circular plate. Dissert. Abstr.

N71-19250*# Martin Marietta Corp., Denver, Colo.
AEROSPACE SYSTEMS PYROTECHNIC SHOCK DATA (GROUND TEST AND FLIGHT). VOLUME 7: INVESTIGATION OF MASS LOADING EFFECTS Final Report, 12 May–12 Nov. 1970
Ivar K. Engelsgjerd and W. P. Rader 12 Nov. 1970 127 p
(Contract NAS5-21241)
(NASA-CR-116019) Avail: NTIS CSCL 20K

The results are presented of a test and analysis program to determine the effect of weight variation in mounted subassemblies on the pyrotechnic shock environment at the interface of the subassembly and the mounting structure. This effect, designated as mass loading, was studied for two types of aerospace mounting structures. (1) airframe, skin, and stringer structure; and (2) truss structure. An explosive device was used as a controlled source of shock to the loaded and unloaded structures. High frequency accelerometers and associated electronics were utilized to give a frequency capability of 20,000 Hz. The recorded shock transients were digitized at a sample rate of 100,000 samples per second and digital shock spectrum analyses were performed with a damping ratio of 5%. For each accelerometer, comparison plots were made of the spectra obtained from the bare structure and three different weight configurations. The results are presented graphically and a discussion of the significant findings is given. D.L.G.

N71-19274*# Techtran Corp., Glen Burnie, Md.
CREEP-RUPTURE STRENGTH OF REINFORCED PLASTICS UNDER UNIAXIAL COMPRESSION [KRATKOVREMENNAYA PROCHNOST ARMIROVANNYKH PLASTIKOV PRI ODNOOSNOM SZHATII]
A. M. Skudra et al Washington NASA Jan. 1971 14 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), v. 5, Jul.–Aug. 1969 p 621–628
(Contract NASw-2037)
(NASA-TT-F-13441) Avail: NTIS CSCL 20K

Creep rupture strength of unidirectionally and orthogonally reinforced plastics under compression along the elastic symmetry axes is investigated. The strength and deformation properties of the components of the plastics and the orientation of the rupture (shear) plane are taken into account. Relations for determining the compression of reinforced plastics with allowance for these factors are proposed. Author

N71-19275# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL INVESTIGATION OF THE VIBRATIONS OF AN ELLIPSOIDAL SHELL CONTAINING FLUID
V. I. Borisenko et al 1970 4 p ref Transl. into ENGLISH from Prikl. Mekh. (Ukrainian SSR), v. 6, no. 11, 1970 p 118–121

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The degree of fluid influence on the vibration frequency of an ellipsoidal shell is discussed. The shell vibration frequencies were measured for different fluid levels and different vibration modes which were characterized by a different number of meridian modal lines passing through the fixed pole of the shells. A check on the absence of nodal parallels was accomplished by using a piezoelectric probe. Author

N71-19276*# Grumman Aerospace Corp., Bethpage, N.Y.
FINITE ELEMENT ANALYSIS OF STRUCTURES IN THE PLASTIC RANGE
H. Armen, Jr., A. Pifco, and H. S. Levine Washington NASA Feb. 1971 281 p refs
(Contract NAS1-7315)
(NASA-CR-1649) Avail: NTIS CSCL 20K

An extension of finite-element methods to provide analytical means for determining the nonlinear response of aircraft structures is presented. Consideration is given to material and geometric nonlinearity, acting separately or in combination. The methods developed are applicable to loading conditions that cause either membrane stresses or pure bending, or both in combination. The finite-element analysis methods for material nonlinearity can account for the Bauschinger effect for biaxial stress states by using the Prager-Ziegler kinematic hardening theory of plasticity. Application of the methods is made to several simple structures including notched bars and rectangular, circular, and annular plates, although it should be noted that these methods are fully capable of being applied to complex, built-up structures. Good correlation is obtained between results from the present analysis and existing experimental and/or analytical results. Author

N71-19277# Sandia Corp., Albuquerque, N.Mex.
SLADE: A COMPUTER PROGRAM FOR THE STATIC ANALYSIS OF THIN SHELLS
Samuel W. Key Nov. 1970 191 p refs Sponsored by AEC
(SC-RR-69-369) Avail: NTIS

A finite element method FORTRAN program designed for the static analysis of thin shells is presented. A doubly curved, arbitrary quadrilateral element is utilized. The element is based on a minimum potential energy principle for thin shells. Since the majority of aerospace structures are based on shells of revolution, the program is designed specifically for a shell the reference surface of which is a portion of an axisymmetric surface. The program allows up to five separate layers and up to five separate elastic anisotropic materials with temperature-dependent properties. The program handles variable thickness shells and allows thickness discontinuities along element boundaries. It provides for both normal and tangential surface loads and for temperature changes through the thickness as well as varying temperatures over the reference surface. Over any portion of the boundary, a choice of thirteen separate boundary conditions is available. The program computes static deformations, stresses, and stress resultants occurring in the shell. Author

N71-19280*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
EQUIVALENT SPRING-MASS SYSTEM FOR NORMAL MODES
R. M. Bamford, B. K. Wada, and W. H. Gayman 15 Feb. 1971 45 p refs
(Contract NAS7-100)
(NASA-CR-116825; JPL-TM-33-380) Avail: NTIS CSCL 20K

A significant reduction of independent variables is made possible by using the normal modes of structural subsystems as independent variables. A technique is described that can be used to generate equivalent spring-mass models for the normal modes of a structural subsystem when the generalized mass matrix and resonant frequencies are available. Where modal truncation is employed, the residual mass matrix is used to preserve the correctness of the rigid-body mass properties. Applications of the modeling technique and the residual mass matrix are discussed. Author

N71-19281*# National Aeronautics and Space Administration, Washington, D.C.
NASA SPACE VEHICLE DESIGN CRITERIA (STRUCTURES): STRUCTURAL VIBRATION PREDICTION
J. S. Archer (TRW Systems Group) Jun. 1970 41 p refs
(NASA-SP-8050) Avail: NTIS CSCL 20K

Space vehicle structural vibration resulting from induced or natural environments and with methods of determining internal structural loads and stresses caused by such vibrations are considered. Structural vibration causes internal loads and stresses in structural components and localized loads at attachment points where equipment is supported by the structure. The degree or magnitude of structural response may be expressed as an acceleration or displacement of various critical points as a function of time, as a weighted average acceleration (root mean square), or as spectra of acceleration or stresses as functions of frequency at discrete times. Severe vibration of space vehicle structural elements usually results from rocket noise and from aerodynamic noise and buffet. Severe vibration can also result from other sources, such as thrust oscillation and rocket-engine resonances, wind gust and shear, transportation, tests, operation of internal equipment, and unstable dynamic coupling of the structure with the control system or with the propulsion system. Author

N71-19282 Stanford Univ., Calif.
AN EXPERIMENTAL STUDY OF WALL MOTIONS IN CIRCULAR CYLINDRICAL SHELLS UNDER COMBINED LOADING
James Insley Craig, II (Ph.D. Thesis) 1969 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-1513

Ten cylindrical shells were tested under combined torsion and axial compression. Contours of the shell wall displacement are presented and it is ascertained that the magnitude of initial imperfection in the shape of the buckle amounts to 5 to 6% of the wall thickness. Longer wavelength imperfections up to 50% of the wall thickness occur simultaneously, however. Spectral analyses reveal that these longer wavelengths are relatively unaffected by the developing prebuckling distortions. The procedure is applied at selected points on the shell and, also, to generalized areas by means of the spectral analysis. Evidence is presented which indicates that in a realistic shell there is, depending on the type of loading, a critical area of imperfection with a particular orientation that determines the buckling behavior. Dissert. Abstr.

N71-19319# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMIC STABILITY OF A SCHEMATIC CANTILEVER SUBJECTED TO A FOLLOWING PULSATING LOADING
D. Kh. Tsveniashvili et al 30 Oct. 1969 4 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 6, no. 11, 1970 p 134-137
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An estimate is made of the effect of load rotational inertiality on the disposition of dynamic instability domains for a following pulsating load. A rod in the form of an elastic, massless element with a mass lumped at the end is analyzed. Differential equations of motion for a time dependent loading are given. A relationship is derived for constructing the principal instability domain boundaries. E.C.

N71-19327# Sandia Corp., Albuquerque, N.Mex.
EQUATION FOR ROD OSCILLATIONS AT HIGH TEMPERATURES
N. I. Kalynayak et al 9 Nov. 1970 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela, no. 2, 1970 p 121–127
(SC-T-70-4042) Avail: NTIS

Longitudinal oscillations of a uniform rod at high temperatures are analyzed. The temperature field is assumed to be known. Differential equations are derived under the condition that the coefficients are functions of temperature. The equations are solved using an asymptotic method. E.C.

N71-19337# California Univ., Livermore. Lawrence Radiation Lab.
ANALYSIS OF STRUCTURAL RESPONSE DATA ON BURIED STRUCTURES IN THE NOGGIN AND CREW UNDERGROUND NUCLEAR TESTS
Alexander Blake and Jerome P. Dow 2 Sep. 1970 61 p refs Sponsored by AEC
(UCRL-50867) Avail: NTIS

At several levels in the emplacement hole for each nuclear device, strain gages, velocity gages, and accelerometers recorded the response of the hole casing and the line-of-sight (LOS) pipe inside it to the ground shock from the nuclear explosion. Vertical velocity gages and accelerometers were also placed at corresponding levels in a nearby satellite hole to measure particle motion in the earth materials. Structural response data from two levels in each emplacement were correlated with theoretical response predictions based on a nested cylinder model, using earth motion data from the satellite holes. The agreement is good enough to confirm the suitability of the nested cylinder model as a basis for preliminary LOS pipe design at least with regard to withstanding pressures induced by ground motion. A computer code based on nested cylinders is presented for calculating pressure attenuation factors and making parametric studies on typical nuclear-explosive emplacement systems. Author (NSA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-18156# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.
SOLUTION OF THERMALIZATION PROBLEMS BY THE QUASI-DIFFUSION METHOD
G. Ya. Trukhanov 1969 35 p refs In RUSSIAN
(IAE-1875) Avail: AEC Depository Libraries

A description is presented of the extension of the quasi-diffusion method of solving the kinetic equation to problems of thermalization. The rapid convergence of the quasi-diffusion method in such problems, for a broad range of heterogeneous systems with high temperature gradients and strong absorption, is demonstrated (the presence of resonance absorbers is also considered). The effect of chemical bonds and kinetic effects on differential neutron spectra and on their integral characteristics in graphite - water absorptive systems in the presence of temperature jumps is studied at the graphite - water interface. A summary is given of the iteration method, which combines the principles of the collision method with those of the overlapping-group method. A corresponding system of equations is derived. Author (NSA)

N71-18157# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
MEASUREMENTS OF FILM CONDENSATION HEAT TRANSFER COEFFICIENTS ON VERTICAL TUBES FOR NITROGEN, HYDROGEN, AND DEUTERIUM
Rolf Ewald and Paul Perroud 1970 21 p refs Presented at Cryog. Eng. Conf., Boulder, Colo., 17–19 Jun. 1970
(CEA-CONF-1634; CONF-700628-1) Avail: AEC Depository Libraries

Experiments carried out with a Frigoduc or cryogenic heat pipe (i.e., a device composed of a boiler connected to a condenser by a pipe through which a cryogenic fluid flows) have made possible the study of heat exchange phenomena at the condenser wall. The condensation surface is made of vertical smooth stainless steel tubes containing a cryogenic liquid boiling under constant pressure. On the external surface, vapor of the same fluid coming from the boiler (except for deuterium, where liquid hydrogen was used to condense the vapor) is condensed under a pressure depending on the exchanged thermal power. After a brief review on the techniques used, tables and curves for nitrogen, hydrogen, and deuterium heat fluxes are presented as a function of the temperature variation at bulk saturation, as well as heat transfer coefficients. Author (NSA)

N71-18220# Societa Richerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
FORCED CONVECTION BURNOUT AND HYDRODYNAMIC INSTABILITY EXPERIMENTS FOR WATER AT HIGH PRESSURE. PART 7: BURNOUT HEAT FLUX MEASUREMENTS ON 3 BY 3 ROD BUNDLES WITH NON-UNIFORM HEAT GENERATION
A. Campanile, G. Galimi, M. Goffi, and G. Passavanti 19 Jun. 1970 42 p refs
(EUR-4514) Avail: AEC Depository Libraries

Burnout experiments conducted with high pressure water in 3 x 3 rod bundles characterized by singularities either in the geometry or in the heat generation are reported. Data are presented which concern the following experimental conditions: obstruction in the flow area, some nonuniform transversal heat flux distributions and a nonuniform heat generation in both transverse and axial directions. Whenever possible, the water temperature at several positions of the exit flow area of the channel was taken. Further, for each experiment the location of the burnout in the rod bundle was recorded. Author (NSA)

N71-18313# Battelle-Northwest, Richland, Wash.
AMOUNT AND CHARACTERISTICS OF PLUTONIUM MADE AIRBORNE UNDER THERMAL STRESS
J. Mishima and L. C. Schwendiman 20 Oct. 1970 10 p Presented at the 5th Midyear Symp. of the Health Phys. Soc., Idaho Falls, Idaho, 3–6 Nov. 1970 Submitted for publication
(Contract AT(45-1)-1830)
(BNWL-SA-3379; Conf-701106-1) Avail: NTIS

The quantity and nature of the particles airborne when plutonium metal or compounds are subjected to thermal stresses are under study. An analysis was made of 46 incidents occurring in the nuclear industry from 1952 to 1967, and the incidents cataloged as to nature of the material involved, initiating event, and consequences. Laboratory studies were conducted to investigate the behavior of plutonium and its compounds when subjected to thermal stresses which might occur in overheating situations. Fractional release rate was measured for plutonium metal, plutonium nitrate, plutonium fluoride, and plutonium oxide when subjected to temperatures up to 1000 C. Release from heated solutions of plutonium nitrate was measured for several heating rates. Rate of release from combustion of small samples of four materials impregnated with powder or with nitrate was measured. The range of release rates is presented. Author (NSA)

N71-18314# Brookhaven National Lab., Upton, N.Y.
BOILING OF LIQUID ALKALI METALS IN TUBES
B. S. Petukhov et al Sep. 1970 22 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur, Akad. Nauk SSR (Moscow), v. 8, no. 2, 1970 p 309–318
(BNL-tr-365) Avail: NTIS

An analysis of the state of the art in boiling alkali metal technology is presented which shows that investigation in this area is in its initial stages. A comparison of data on heat transfer to boiling alkali metals in tubes with calculated values for this phenomenon is included and examined. NSA

N71-18393# California Univ., La Jolla. Dept. of Physics.
PRINCIPLES AND METHODS OF DILUTION REFRIGERATION, 2
John C. Wheatley, R. E. Rapp, and R. T. Johnson 1970 71 p refs
(Contract AT(04-3)-34)
(UCSD-34-P-143-32) Avail: NTIS

Fundamental questions that lead to degradation in the performance of a dilution refrigerator are considered: namely, convection on the dilute side and superfluid on the concentrated side. Experimental results are presented for a film suppressing still used in conjunction with a continuous heat exchanger (several designs are considered) and a variable number (0 to 6) of step heat exchangers of a copper foil type with a high surface area to a viscous impedance ratio. Quantitative measurements of viscous heating on the dilute side are presented as well as measurements of thermal resistance on the dilute and concentrated side. The properties of the refrigerator under external heat load are considered. Author (NSA)

N71-18561*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF VARIOUS DIFFUSER DESIGNS ON THE PERFORMANCE OF AN EXPERIMENTAL TURBOJET COMBUSTOR INSENSITIVE TO RADIAL DISTORTION OF INLET AIRFLOW
James A. Biaglow Washington Mar. 1971 19 p refs
(NASA-TM-X-2216; E-5975) Avail: NTIS CSCL 21E

Tests were performed on an experimental combustor insensitive to shifts in the radial velocity profile at the compressor outlet. The purpose was to investigate alternate diffuser designs for this type combustor. Test conditions were atmospheric pressure, 600 F inlet air temperature, and average exit temperatures up to 2200 F. The fuel used was ASTM A-1. The performance of a dump-type diffuser and a 53 deg wide-angle diffuser showed that these designs of simple construction may be interchanged with that of the previously developed combustor without penalty. Tests of three diffusers with different axial lengths but similar to the design used in the previously developed combustor were investigated only at isothermal conditions with 600 F inlet air. When the diffuser length to inlet height ratio was changed from 4.0 to 7.0, at an inlet Mach number of 0.30, the combustor total-pressure loss decreased from a nominal value of 7.1 to 5.4 percent. Author

N71-18621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GIG: A FORTRAN 4 GEOMETRY INPUT GENERATOR PROGRAM FOR A FINITE-ELEMENT HEAT-TRANSFER CODE
Earl L. Sprague Washington Mar. 1971 26 p refs
(NASA-TM-X-2204; E-5978) Avail: NTIS CSCL 20M

A computer program was written to generate geometrical data required as input to a finite-element heat transfer code. With a minimum of input information, the program generates data for any two dimensional geometry configuration defined by straight line segments. Adaptability, accuracy of results, and ease of use are the prime considerations of the program. Author

N71-18680*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
HEAT TRANSFER FROM PARTIALLY IONIZED ARGON FLOWING IN A CONDUCTING CHANNEL WITH AN APPLIED, TRANSVERSE MAGNETIC FIELD
E. J. Roschke 15 Dec. 1970 63 p refs
(Contract NAS7-100)
(NASA-CR-116800; JPL-TR-32-1510) Avail: NTIS CSCL 20M

Wall heat transfer measurements were obtained for laminar flow of partially ionized argon flowing in a square channel with and without an applied, transverse magnetic field. Tests were conducted for subsonic flows and for flows that were supersonic before a magnetic field was applied. Principal results are presented in terms of the Stanton number. The Stanton number increased by a factor of as much as six at the highest magnetic field strengths available (nearly 10 kG) over results observed at zero field. It is believed that the large increases in heat transfer observed with an applied magnetic field were due to (1) a small but sufficient amount of Joule heating, which caused significant changes in the temperature distribution, augmented or accompanied by (2) magnetically induced nonequilibrium ionization. Author

N71-18710# Aerospace Corp., El Segundo, Calif. Material Sciences Lab.
A DIFFUSIVITY MEASUREMENT TECHNIQUE FOR VERY HIGH TEMPERATURES Technical Report, Aug. – Nov. 1968
Josef Kasper and Ernest H. Zehms 30 Aug. 1970 34 p refs
(Contract F04701-70-C-0059)
(AD-715900; TR-0059(9250-02)-1; SAMSO-TR-70-416) Avail: NTIS CSCL 20/13

The report treats analytical aspects of the Double Disc and Heat Shield Methods developed by the authors for the determination of the diffusivity of materials at very high temperatures. These methods employ a periodic irradiation on one side of a thin disc. The phase shift between the temperature variations of the front and back sides is measured and used to determine the diffusivity of the material. The matrix analysis given shows that only for the back side must the heat loss parameter be known or its effect be eliminated by the above-mentioned methods. The success of the techniques is demonstrated. Author (GRA)

N71-18729# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.
A KINETIC STUDY OF THE CATALYTIC DEHYDROGENATION OF METHYLCYCLOHEXANE AT 600, 650, AND 700 F AND A PRESSURE OF 5 ATMOSPHERES
Herbert R. Lander, Jr. Oct. 1970 137 p refs
(AD-715926; AFAPL-TR-70-46) Avail: NTIS CSCL 21/4

Fuel enthalpy offers a readily available heat sink and can be used to dissipate the aerodynamic heating that results from sustained high speed flight in the earths atmosphere, but is effective only up to certain levels of temperature. Catalytically enhanced heat-absorbing chemical reactions, however, can be used to increase the heat sink capacity from the fuel enthalpy. These reactions include dehydrogenation, dehydrocyclization, depolymerization, and hydrocracking. The dehydrogenation of methylcyclohexane over a commercially available platinum-alumina catalyst bed will approximately double the heat sink from fuel enthalpy. The dehydrogenation reaction was studied at temperatures of 600, 650, and 700 degrees F and a pressure of 5 atmospheres. Tabulations and plots of test data are presented on the effects of time, reaction rate, molar feed ratio, presence of toluene, presence of reactor inerts, reaction pressure, and temperature. Author (GRA)

N71-18748*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF TEMPERATURE DISTRIBUTIONS IN

THIN SHELLS OF REVOLUTION BY THE FINITE ELEMENT METHOD

Howard M. Adelman and Donnell S. Catherines Washington Feb. 1971 53 p refs

(NASA-TN-D-6100; L-7324) Avail: NTIS CSCL 20M

A finite element procedure and the resulting computer program are described for computing steady state temperature distributions in thin shells of revolution having general meridional curvature. The procedure is applicable to shells subjected to a very general set of thermal loading conditions including applied heat flux at the surfaces, convective heat transfer with the surroundings, and equivalent loadings due to specified temperatures at points on the shell. The program is used in a number of calculations for configurations of interest and comparisons are made with exact analytical solutions. Author

N71-18753# Science Applications, Inc., La Jolla, Calif.

MULTIFREQUENCY AND MULTIDIMENSIONAL ASPECTS OF X-RAY TRANSPORT Final Report, Oct. 1969 – Sep. 1970

Robert J. Latko and Gerald C. Pomraning Nov. 1970 149 p refs

(Contract DASA01-70-C-0028)

(AD-715476; SAI-70-113; DASA-2572) Avail: NTIS CSCL 20/13

The report discusses multifrequency and multidimensional aspects of radiative transfer problems. A new grey, or multigroup, equation of transfer is derived which is consistent with the moment equation often used in numerical work (i.e., in the VERA and DRAD codes). This equation involves generalization, to strong temperature gradients, of the Planck and Rosseland mean opacities. The report also discuss a possible method for solving the two-dimensional moment equations which has the potential of saving large amounts of computer time. This method, called synthesis, involves representing the two-dimensional solution by a small number of coupled, one-dimensional solutions. A numerical example is given indicating the potential of the method. Author (GRA)

N71-18796*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SPACE SHUTTLE VEHICLE ROCKET PLUME IMPINGEMENT STUDY FOR SEPARATION ANALYSIS Final Report

Morris M. Penny, Carl J. Wojciechowski, and Robert J. Prozan Jan. 1971 74 p refs

(Contract NAS9-11156)

(NASA-CR-114875; LMSC-HREC-D-162852; HREC-1156-2; MSC-02543) Avail: NTIS CSCL 20M

A discussion is presented of several items of engineering interest involved in the study. The aspects considered include: (1) the plume simulation used, (2) engine-out analysis, and (3) shock interaction heating problems. In addition, a description is given of inputs, computer tape setups, etc. for the computer programs which are necessary to any subsequent analyses of the plume impingement problems. Author

N71-18811# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.

THERMODYNAMIC PROPERTIES OF PROPELLANT COMBUSTION PRODUCTS Final Scientific Report

Norman D. Potter, M. H. Boyer, Fred Ju, D. L. Hildenbrand, and E. Murad 31 Aug. 1970 160 p refs

(Contract AF 49(638)-1577)

(AD-715567; U-4859; AFOSR-70-2311TR) Avail: NTIS CSCL 7/4

Mass Spectrometric studies of isomolecular, homogeneous gas phase equilibria have been used to determine the heats of formation of the following gaseous species: ZrF, ZrF2, TiF, TiF2, TiF3, ZrCl, ZrCl2, ZrCl3, TiCl, TiCl2, CaCl, SrCl, BaCl, BCl, GaF, InF, and TlF. The vaporization of TiF3 and TiCl3 have been studied using simultaneous torsion- and gravimetric effusion. The vaporization of Al and Li have been studied and the heats of vaporization obtained. The decomposition pressures of aluminum carbide and the lithium aluminates have been measured using torsion effusion. The vapor pressure of very pure gold has been measured. Simultaneous torsion-gravimetric effusion measurements fixed the molecular weight of LiF vapor. Beam modulation mass spectrometry has elucidated the electron-impact cracking pattern for LiF vapor. Author (GRA)

N71-18812# Council for Scientific and Industrial Research, Pretoria (South Africa).

SAVE WATER: USE AIR COOLED HEAT EXCHANGERS AND CONDENSERS

B. J. Zulch, ed. Oct. 1970 4 p *Its* Tech Inform. for Industry, V. 8, No. 10

Avail: NTIS

The operating characteristics and costs of air-cooled heat exchangers and condensers used in industry are discussed. Various computer programs for design and cost analysis of such devices are described. The advantages of air cooling over water cooling are given, with emphasis on conservation of water in countries with limited water resources. R.B.

N71-18813# National Research Council of Canada, Ottawa (Ontario).

THERMOELECTRIC POWER OF Pt 10 PERCENT Rh/Pt THERMOCOUPLES SUBJECTED TO SUDDEN COOLING [POTERE TERMOELETRICO DI TERMOCOPPIE Pt PIU 10 PER CENTO Rh VERSO Pt SOTTOPOSTE A BRUSCO RAFFREDDAMENTO]

T. Ricolfi et al 1970 14 p refs Transl. into ENGLISH from Termotecnica (Milan), v. 21, no. 11, 1967 p 29–33

(NRC-TT-1429) Avail: NTIS

The changes in resistivity and thermoelectric power of quenched high purity platinum and Pt 10% Rh wires were studied. The amount of extra resistivity from different quenching temperatures is given and the annealing behaviour at 700 K is shown. The quenching effects are related to the precision of the Pt 10% Rh/Pt thermocouple. Author

N71-18828# Weapons Research Establishment, Salisbury (Australia).

AN EVALUATION OF ERRORS THAT OCCUR IN THE SOLUTION OF THE INVERSE HEATING PROBLEM FOR FLAT PLATES AND HEMISPHERICAL SHELLS

I. C. Heron Nov. 1970 21 p refs

(WRE-TN-HSA-168) Avail: NTIS

An investigation has been made of the errors that occur in calculating temperatures at the outer surface of a hemispherical shell from measured data at the inner surface. It is shown that there exists a critical thickness above which the numerical process is unstable, and this critical value is calculated theoretically. The effects of random errors in the measured data are also evaluated, and it is shown that it is necessary first to smooth the data if errors are to be minimized. Author

N71-18882*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL PERFORMANCE AND COMBUSTION STABILITY OF A FULL SCALE DUCT BURNER FOR A SUPERSONIC TURBOFAN ENGINE

J. Robert Branstetter, Albert J. Juhasz, and Peter W. Verbulecz Washington Mar. 1971 84 p refs

(NASA-TN-D-6163; E-5879) Avail: NTIS CSCL 20M

A 67.7-in. (172-cm) diameter flight weight, annular diffuser and combustor assembly for the fan stream of a duct burning turbofan underwent numerous modifications to achieve a highly efficient geometry and stable combustion. The apparatus was tested in a connected pipe facility at conditions simulating those of a supersonic transport plane. Two zones of fuel injection provided overall fuel-air ratios of 0 to 0.050. Air entered the upstream combustion zone by means of ram-scoops. Effort was devoted to combating combustion instability (70 to 470 Hz) encountered at many test conditions. These efforts, only partially successful, are described along with other performance results. Author

N71-18890 Arizona Univ., Tucson.
THE EFFECT OF A TRANSVERSE MAGNETIC FIELD ON A PROPAGATING PLANE GASEOUS DETONATION WAVE
John Peter Thomas (Ph.D. Thesis) 1969 153 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 70-1683

An experimental investigation is reported of the effect a transverse magnetic field has on certain characteristics of a propagating steady state detonation wave. The wave characteristics measured were the propagation velocity and the variation in pressure behind the wave front. A theoretical calculation is also contained, based upon a simplified one dimensional model for the wave propagating through the magnetic field, which predicts that there should be no observable changes in these characteristics. The detonation wave was generated in a 1 in. tube of square cross-section using oxyacetylene mixtures of varying mixture ratios and initial pressures. Its propagation velocity was measured using electronic counters whose stop and start circuits were actuated by means of piezo-electric gages, which were placed at measured intervals along the tube axis. The variation in pressure behind the wave front was measured by photographing the trace on an oscilloscope screen. The measured values of propagation velocity and pressure at the rarefaction-detonation wave interface agree closely with those already reported by various investigators. Dissert. Abstr.

N71-18944# Los Alamos Scientific Lab., N.Mex.
SONIC LIMITATIONS AND STARTUP PROBLEMS OF HEAT PIPES
J. E. Deverall, J. E. Kemme, and L. W. Florschuetz (Ariz. State Univ.) Sep. 1970 25 p refs
(Contract W-7405-eng-36)
(LA-4518) Avail: NTIS

In the design of heat pipes, consideration must be given not only to the internal structure and fluid dynamics of the pipe but also to the external conditions imposed upon it. Several tests of heat pipes were made under different operating conditions to demonstrate the effect of sonic vapor velocities and related startup problems which influence heat-pipe design. Derivations are presented for the pressure, temperature, and density relationships encountered in the vapor flow stream, and tables of sonic limits for various heat-pipe fluids are included. Author (NSA)

N71-19049 Rensselaer Polytechnic Inst., Troy, N.Y.
THE TURBULENT TEMPERATURE DISTRIBUTION IN A HORIZONTAL LAYER OF LIQUID HEATED FROM BELOW
Irving William Gazda (Ph.D. Thesis) 1969 245 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.20 Order No. 70-2618

The temperature fields resulting from turbulent thermal convection in horizontal liquid layers are analyzed in the light of various proposed theories. Two silicone oils of nominal viscosity 0.65 cs. and 2.0 cs. were utilized as the experimental fluids and eight different Rayleigh numbers were investigated ranging from 7.59 × 10 to the 5th power to 3.21 × 10 to the 8th power. A 0.0005 in. diameter thermocouple probe was used to measure the mean temperature and rms of the fluctuating temperature at various levels in the horizontal liquid layer. The upper surface of the experimental chamber was cooled by a circulating water flow and further provided for determination of the Nusselt number for each flow situation. Dissert. Abstr.

N71-19050# California Univ., La Jolla. Dept. of Physics.
COMPRESSIONAL COOLING OF HE 3 TO MILLIDEGREE TEMPERATURES
R. T. Johnson and J. C. Wheatley [1970] 50 p refs
(Contract AT(11-1)-34)
(UCSD-34-P-143-27) Avail: NTIS

A study of adiabatic compressional cooling of a two phase mixture of solid and liquid He 3 was made. Details of the experimental arrangement are given. Using a flexible elastic low temperature He 3 cell which is compressed by liquid He 4 and precooled by a continuously operating dilution refrigerator, cooling to below 2 m K was obtained from starting temperatures near 20 m K. Frictional heating is remarkably low. Calculations are presented which investigate the fraction of solid formed and which suggest rather long thermal equilibrium times in the solid He 3 nuclear spin system. Application of the method to the production of bulk polarized He 3 nuclei is discussed. Author

N71-19289*# AiResearch Mfg. Co., Los Angeles, Calif.
COMPARISON OF HYDROGEN AND METHANE AS COOLANTS IN REGENERATIVELY COOLED PANELS
C. E. Richard and F. M. Walters Washington NASA Mar. 1971 43 p refs Revised
(Contract NAS1-5002)
(NASA-CR-1652; Rept-67-2490-Rev-1) Avail: NTIS CSCL 20M

Comparisons are made of the minimum weights, ranges of applicability, and coolant requirements of methane-cooled, and hydrogen-cooled, structural panels determined from analytical studies of flat panels designed for heat fluxes up to 500 Btu/sec-sq ft and pressure loads up to 250 psi. Author

N71-19290*# California Inst. of Tech., Pasadena.
HEAT TRANSFER RESEARCH IN THE SEVENTIES
R. H. Sabersky Aug. 1970 62 p Presented at the 4th Intern. Heat Transfer Conf., Versailles, France Sponsored by NSF
Avail: NTIS

An attempt was made to collect the opinions and ideas of workers in the field of heat transfer as to the future course of research in this area and its relation to applied problems. Interviews were conducted and memoranda were obtained from those actively engaged in research as well as from persons concerned with the design and operation of equipment and processes. The material presented reflects the information obtained in this way and is aimed at: (1) serving as a reference to those engaged in research in planning their own programs; (2) helping prospective students in orienting themselves when selecting an area of specialization; and (3) giving a more complete overview of possible future endeavors to those who may be in a position to sponsor research work. Author

N71-19296*# AiResearch Mfg. Co., Los Angeles, Calif.
FABRICATION AND STRUCTURAL EVALUATION FOR REGENERATIVELY COOLED PANELS
C. Demogenes, O. Jones, C. E. Richard, J. D. Duncan, and W. G. Flieder Washington NASA Mar. 1971 98 p refs
(Contract NAS1-5002)
(NASA-CR-1651; Rept-68-3573) Avail: NTIS CSCL 20M

Results of experimental evaluations to select materials and

fabrication techniques for plate-fin sandwiches suitable for regeneratively cooled structural panel applications are presented. Included are results of parent metal tensile tests and burst, creep rupture, and flexure tests of brazed plate-fin specimens of Waspaloy, Inconel 718, Inconel 624, and Hastelloy X. Author

N71-19298* Oregon State Univ., Corvallis.
AN EXPERIMENTAL INVESTIGATION OF TRANSITION POOL BOILING
Tadao Aoki (Ph.D. Thesis) 1970 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 70-1436

The heat transfer phenomena studied were associated with pool boiling from a flat horizontal surface facing upward with the bulk liquid at its saturation temperature. The analysis of boiling sound and the investigation of the transition boiling mechanism constituted the essence of the study. The distinctively large sound intensity with predominant frequency components of 250 Hz and 500 Hz was observed during transition boiling. From the photographic studies of surface temperature variation, it was concluded that the heat transfer mechanism at relatively low heat flux levels of transition boiling involves the direct contact between liquid and the hot surface followed by a spheroidal state of the liquid. At higher heat flux levels while the liquid was in the spheroidal state, its contribution to total heat transfer increased with a decrease in surface temperature. Dissert. Abstr.

N71-19333# Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.
BOILING AND CONDENSATION IN A LIQUID FILLED ENCLOSURE
Avram Markowitz and Arthur E. Bergles Jan. 1971 117 p refs
Sponsored by Raytheon Co., Bedford, Mass.
(TR-29077-73) Avail: Issuing Activity

A combined experimental and analytical investigation of boiling and condensation in a liquid-filled enclosure, with water and Freon-113 as the working fluids, is described. The operating characteristics of a boiling system, utilizing a condenser submerged in the fluid, are presented and related to specific operational modes and thermal transport mechanisms. A lower bound of operation, corresponding to natural convection heat transfer at both the heated and condenser surfaces, is identified. Similarly, for the commonly encountered range of system operation, a condensive upper bound is identified and shown to correspond to vapor space condensation. A possible technique for augmenting condensation heat transfer on horizontal surfaces is examined in an attempt to raise the condensive upper bound of submerged condenser operation. A doubly-rippled surface with small, constant radius of curvature undulations is shown to yield a factor of two increases in the rate of vapor space condensation based on the projected area of the condenser surface. A systematic design procedure for submerged condenser systems utilizing the proposed models and correlations is described and related to typical design considerations. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N71-18241# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
MATERIALS RESEARCH Annual Technical Report, 16 Sep. 1969–15 Sep. 1970
1 Dec. 1970 230 p refs Sponsored in part by AEC, NSF, NIH, Dept. of Transportation, and Natl. Air Pollution Admin.
(Contracts ARPA SD-90; DAHC15-67-C-0222)
(AD-714861)Avail: NTIS CSCL 11/7

Contents: Solid state and molecular theory group; Nonequilibrium quantum statistical mechanics; Atomic resonance and scattering; Neutron diffraction and neutron physics studies; Critical phenomena in fluids and solids; Experimental studies of critical phenomena; The dynamics of quantum fluids; Cooperative phenomena, solid state physics, statistical mechanics and biological physics; Order-disorder phenomena; Molecular crystals; Semiconductor materials and devices; Low mobility and amorphous semiconductors; Microwave and quantum magnetics; Crystals physics and optical electronics; Physical metallurgy; High temperature metallurgy; Polymers and glasses; Metals processing - casting and solidification; X-ray and electron optics; Plastic deformation and strain hardening; Mechanisms of fatigue damage in semi-brittle materials at elevated temperatures and fatigue in composites; Damage in composite materials; Surface properties and processes; Properties of cementitious materials; Heterogeneous catalysis; and Molecular beam detector - adsorbate sputtering. GRA

N71-18264# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
A PROTOTYPE MANAGEMENT DECISION SYSTEM FOR PLANNING AND CONTROL
Ronald Segel Nov. 1970 34 p refs
(Contract N00014-67-A-0216-0007)
(AD-715663; TR-71-11) Avail: NTIS CSCL 5/1

The value of timely information as an aid in management decision making has long been recognized. For well structured and predictable problems, conventional batch processing computer techniques and management information systems technology appear to be capable of keeping pace with the rapidly increasing information needs. However, unstructured and poorly defined problems often confront high level managers in military organizations, industry or government. It appears that an interactive Management Decision System (MDS), operated and directly controlled by the manager, could provide significant assistance in making the required decisions. The report describes a prototype system that has been implemented to illustrate and evaluate the concept, and to form a basis for subsequent research. Author (GRA)

N71-18265# Georgia Univ., Athens. Computer Center.
EXPAND THE UNIVERSITY OF GEORGIA INFORMATION CENTER Annual Report, 1 Oct. 1969–30 Sep. 1970
James L. Carmon [1970] 75 p refs
(Grant NSF GN-851)
(PB-195274) Avail: NTIS CSCL 05B

The principal tasks were the presentation of workshops and seminars for users of the service, the addition of six new data bases to the inventory of available services, development of manuals and other user guides for both the users and the information scientists, and the development of an integrated text search system designed for the large volume operations of the center. Data on the types of users, the search profiles and the computer search timings were also examined. Author (GRA)

N71-18431*# National Aeronautics and Space Administration, Washington, D. C.
NASA BRIEFINGS ON SPACE TRANSPORTATION SYSTEM. INTRODUCTORY REMARKS
Homer E. Newell 1970 8 p Presented at the ELDO/NASA Space Transportation Briefing, Bonn, 7–8 Jul. 1970
(NASA-TM-X-68714) Avail: NTIS CSCL 05C

The concept of reusable space transportation is introduced with a view to European cooperation, and its main advantages.

Cost reduction for carrying payloads to orbit, less demanding environment conditions for payloads, and payload retrieval, are outlined. ESRO

N71-18447# National Science Foundation, Washington, D.C.
SCIENTIFIC TECHNICAL AND HEALTH PERSONNEL IN THE FEDERAL GOVERNMENT, 1969
Joel L. Barries and Joseph P. Gannon Nov. 1970 48 p refs
(NSF-70-44) Avail: SOD $0.50

Information is compiled on Federal scientific, technical, and health personnel, their occupations, employment by agencies, work activities, and geographic distribution. This information will be of assistance in the analysis and evaluation of manpower utilization, in the projection of man-power requirements, and in the determination of policies dealing with national manpower resources. Author

N71-18448# Illinois Univ., Urbana. Materials Research Lab.
MATERIALS SCIENCES RESEARCH Annual Technical Report, 1969–1970
1 Jan. 1971 204 p refs
(Contract DAHC15-67-C-0221)
(AD-715686) Avail: NTIS CSCL 20/12

The research projects summarized include the following: Properties of materials at very low temperatures; Reactions of inorganic complexes in the solid state; Magnetic and optical studies of intermetallic coupling; Nucleation and crystal growth in simple glass systems; Ultraviolet optical properties of solids; Anodic spark deposition of oxide ceramics; Nuclear quadrupole resonance, electronic and infrared spectral studies; Molecular rearrangements of organic compounds; Vibration-rotation spectroscopy of molecules and ions; Electronic structures of metallic alloys; Superconductors; Luminescence, lasers, carrier interaction effects, and instabilities in compound and elemental semiconductors; High-pressure nuclear magnetic resonance study of the dynamic structure of liquids; Investigations of cooperative phenomena at low temperatures; Properties of recombination centers in semiconductors; Magnetic studies in metals; Spin-lattice relaxation and dynamic nuclear orientation; and Electrical properties and phase equilibria in electrically conducting oxides. GRA

N71-18475# Fraunhofer Institut, Freiburg (West Germany).
INVESTIGATIONS OF SPLINTERS ACCELERATED BY EXPLOSION, PART 1 [UNTERSUCHUNGEN AN SPRENGSTOFFBESCHLEUNIGTEN SPLITTERN, TEIL 1]
U. Hornemann Apr. 1969 69 p In GERMAN
(Rept-9/69) Avail: NTIS

Initial velocities and penetration distance of explosively accelerated metal balls were measured, using X-ray flash techniques. The metals were aluminum, steel, and tungsten. The balls, mounted on the front of a cylindrical explosive charge, were accelerated by an "impinging detonation wave." ESRO

N71-18708# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
COOPERATION IN THE FUTURE US SPACE PROGRAMME: INTEREST AND COST TO EUROPE
J. Henrici 1970 17 p Presented at the 4th EUROSPACE US-European Conf., Venice, 22–25 Sep. 1970
Avail: NTIS

Advantages and cost of European space programs with or without American cooperation are discussed. It is concluded that the maximum benefit coupled with the chance of remaining among the leading nations in the field of technology would be derived from participation in the further phases of NASA programs. ESRO

N71-18709# Naval Intelligence Command, Alexandria, Va. Translation Div.
AN ANALYSIS OF PROBLEMS OF ORGANIZATION IN SCIENCE
G. M. Dobrov 16 Dec. 1970 21 p refs Transl. into ENGLISH from the book "Analiz Problem Organizatsii Nauki" Novosibirsk, Nauka, 1967 p 101–120
(AD-715752; NIC-TRANS-3150) Avail: NTIS CSCL 5/1

Contents: Science as an information process; Scientific development; Men of science; and Planning and forecasting in science. GRA

N71-18857# Defense Documentation Center, Alexandria, Va.
ANNUAL HISTORICAL SUMMARY DEFENSE DOCUMENTATION CENTER, 1 JULY 1969–30 JUNE 1970
1 Dec. 1970 52 p
(AD-715500) Avail: NTIS CSCL 5/2

The summary presents highlights of the more significant activities and achievements of the Defense Documentation Center during FY 1970 including: (a) DDC and the Scientific and Technical Community. The DDC role in the DoD Scientific and Technical Information Program continued to expand from providing secondary distribution of Defense-related technical reports to furnishing a coordinated mix of scientific, technical, and management information products and services tailored to the needs of users of the information. (b) DDC Mission Responsibilities. Basic responsibilities are summarized as: (1) acquiring, storing, announcing, retrieving, and providing secondary distribution of results of RDT and E performed or sponsored by military departments and other DoD components. (2) operating the central DoD computer-based data banks of technical and management information resulting from Defense-related efforts in research and technology, and (3) planning and executing a development program to introduce new or improved systems and techniques related to information transfer. (c) Operational and Developmental Activities. The summary describes activities and accomplishments during the year including those in the areas of: (1) technical report services, (2) research and engineering management information services including a variety of data banks and special services, (3) on-line tretrieval, (4) selective documentation services, (5) automatic data processing, (6) microform systems, (7) language and indexing systems, and (8) supporting customer relations and management functions. Author (GRA)

N71-18951# National Academy of Sciences National Research Council, Washington, D.C., Highway Research Board.
PUBLIC TRANSPORTATION TO AIRPORTS: 7 REPORTS
1970 42 p refs Presented at the 49th Ann. Meeting of the Highway Res. Board *Its* Highway Res. Record No. 330
Avail: Issuing Activity

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N71-18957 08-34)
7. THE PHILADELPHIA AIRPORT ORIGIN-DESTINATION SURVEY: A STATISTICAL ANALYSIS J. C. Corradino (Simpson and Curtin, Philadelphia, Pa.) p 30-36 refs (See N71-18958 08-34)

N71-18952# National Academy of Sciences National Research Council, Washington, D.C. Highway Research Board.
MASS TRANSIT TO AIRPORTS: AN OVERVIEW
Kenneth E. Cook *In its* Public Transportation to Airports: 7 Rept. 1970 p 1-4 ref (See N71-18951 08-34)
Avail: Issuing Activity

The current patterns in airport access systems are briefly discussed with the advantages, and disadvantages of mass transit systems. The potential applications of rail, and bus transit systems are also presented. F.O.S.

N71-18953# Japan Airport Terminal Co., Ltd., Tokyo.
THE AIRPORT ACCESS PROBLEM IN TOKYO
Toru Akiyama *In* NAS-NRC Public Transportation to Airports: 7 Rept. 1970 p 5-12 (See N71-18951 08-34)
Avail: Issuing Activity

The mass transit systems used for access to the Tokyo International Airport are studied. A statistical analysis of the traffic patterns shows that 70% of the passengers use automobiles for arrivals and departures. Conclusions reached in considering the access problems to the new Tokyo airport are: (1) City terminals that have passenger check-in facilities are desirable (2) The city terminals should be located in strategic points with easy access to downtown and the airport. (3)Limousine/bus service should be established with specially designed vehicles. F.O.S.

N71-18954# British Airports Authority, London (England).
AIRPORT ACCESS TO HEATHROW AIRPORT, LONDON
George Hole *In* NAS-NRC Public Transportation to Airports: 7 Rept. 1970 p 13-15 (See N71-18951 08-34)
Avail: Issuing Activity

The public transportation requirements for access to London's airports are discussed by considering the traffic position of Heathrow. The existing transportation systems of bus, subway, and trail services to Heathrow are described, and it is concluded that the British Rail duorail system can be adapted to meet the traffic requirements of 2000 passengers per hour in each direction. F.O.S.

N71-18955# Kansas City Area Transportation Authority, Mo.
PROVIDING GROUND ACCESS TO THE KANSAS CITY AIRPORT
Willim Icenogle *In* NAS-NRC Public Transportation to Airports: 7 Rept. 1970 p 16-20 (See N71-18951 08-34)
Avail: Issuing Activity

Based on the recommendations of an engineering survey of the traffic requirements for a freeway system to service the Kansas City International Airport, the design and location of a transitway is presented. One end of the recommended transitway is in the business district, near downtown hotels, and at the airport, buses operate on an elevated road separate from general vehicular traffic. The total cost of this access system is estimated at $30 million. F.O.S.

N71-18956# Department of Transportation, Washington, D.C. Office of the Secretary.
CLEVELAND RAIL TRANSIT AIRPORT SERVICE
George F. Wiggers *In* NAS-NRC Public Transportation to Airports: 7 Rept. 1970 p 21-24 (See N71-18951 08-34)
Avail: Issuing Activity

The rail rapid transit system to Hopkins International Airport was studied to develop the means to make accurate forecasts of transit demands as a mode for airport access. Four types of tripmakers are included in the study. These are: inbound and outbound air passengers, persons meeting or seeing off air passengers, casual visitors to the airport such as sightseers, and employees at the airport. The transit system is a publicly owned, 19-mile, two-track rail rapid transit line with 17-stations on the line. The airport is the last stop on the west end. Travel time to downtown Cleveland is 25-minutes, with trains departing every 10-minutes. It is concluded that most of the air travelers are not residents of Cleveland, and do not have their private automobiles available to them. They require high frequency, dependable, and time saving transportation services. F.O.S.

N71-18957# Massachusetts Bay Transportation Authority, Boston.
AIRPORT ACCESS PLANS FOR BOSTON
Ronald Muehlberger *In* NAS-NRC Public Transportation to Airports: 7 Rept. 1970 p 25-29 refs (See N71-18951 08-34)
Avail: Issuing Activity

The existing access systems for Logan International Airport are presented with plans and recommendations for improvement. It is shown that almost 69% of the travelers use private automobiles as the access mode. The recommended improvements center around a proposed third harbor tunnel to alleviate the severe congestion during rush hours at the Callahan Tunnels, and the Mystic River Bridge. A survey of the airport populations showed that each passenger generated almost one nonflying visitor. The available parking spaces number 5800; by 1980 it is estimated that 17,700 parking spaces will be required. The greatest single improvement to existing systems is considered to be an extension of the rail routes to provide direct connection of the airport with the downtown sections of Boston. F.O.S.

N71-18958# Simpson and Curtin, Philadelphia, Pa.
THE PHILADELPHIA AIRPORT ORIGIN-DESTINATION SURVEY: A STATISTICAL ANALYSIS
Joseph C. Corradino *In* NAS-NRC Public Transportation to Airports: 7 Rept. 1970 p 30-36 refs (See N71-18951 08-34)
Avail: Issuing Activity

A statistical survey of ground and air traffic at the Philadelphia International Airport was taken to help in solving the ground-air interface problems confronting airport activities. An in-flight survey of arriving and departing flights was conducted. Results indicate that a one-directional survey accurately mirrors the reverse direction of travel, and that any analysis of airport ground travel based on data from home-interview surveys should be supplemented by an examination of nonresident air passenger travel. F.O.S.

N71-19320# Detroit Edison Co., Mich. Great Lakes Area Trade Development.
TRANSPORTATION OF FREIGHT IN THE YEAR 2000 WITH PARTICULAR REFERENCE TO GREAT LAKES AREA
James Easton Sep. 1970 140 p refs
Avail: Issuing Activity

The main modes of transportation for the Great Lakes Area, in the year 2000 are examined to assess the freight movement by each mode. The intercity ton milage during the next 30 years is expected to triple the 1970 figure. Shipping on the St. Lawrence Seaway and Great Lakes, railroads, trucking, inland waterways, barges, pipeline system, and air transport are considered with emphasis on the influence of future government policies. F.O.S.

N71-19321# Joint Publications Research Service, Washington, D.C.

MODEL SCIENTIFIC PRODUCTION ASSOCIATION

V. Beletskaya et al 22 Feb. 1971 9 p Transl. into ENGLISH from Ogonek (Moscow), no. 2, 1971 p 16-17

(JPRS-52446) Avail: NTIS

A series of interviews and conversations with officials and engineers of a model scientific production association is reported. Among the articles designed and developed by the production combine are integrated microcircuits, miniaturized television sets, radio communications equipment and electronic computers. R.B.

N71-19322# Joint Publications Research Service, Washington, D.C.

TRANSLATIONS ON USSR POLITICAL AND SOCIOLOGICAL AFFAIRS. NO. 130: INTERNATIONAL LAW AND THE OCEAN FLOOR

G. F. Kalinkin et al 10 Mar. 1971 82 p refs Transl. into ENGLISH from the book 'Morskoye Dno: Komu Ono Prinadlezhit" Moscow, 1970 p 3-6, 29-39; 103-118; 119-166 and 167-170

(JPRS-52585) Avail: NTIS

The international legal aspects concerning the continental shelves, the limits beyond the continental shelves, and the demilitarization of the ocean floor are discussed. Recommendations are made that the United Nations General Assembly adopt a declaration of legal principles regulating the activity of governments with respect to the ocean floor. Emphasis is placed on banning the use of the ocean floor for military purposes. R.B.

N71-19325# Naval Scientific and Technocal Information Centre, Orpington (England).

LIBRARY BULLETIN NO. 10

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NEW NASA PUBLICATIONS

Holographic Instrumentation Applications (NASA SP-248)

Edited by BORIS RAGENT AND RICHARD M. BROWN

The proceedings of a conference held January 13 and 14, 1970, at Ames Research Center to bring together people interested in the development of holographic instrumentation for NASA. Of those in attendance, 42 were from NASA and 10 represented NASA contractors. The conference was arranged in three sessions: first, a general report by representatives of each of the participating centers as to its interest, direction, and effort in the development of holographic instrumentation; second, reports from eight contractors on their work; and third, detailed and specific reports by individual NASA personnel. *Paperbound.* 256 pp. Available from the National Technical Information Service, Springfield, Va. 22151, for $3.00.

Models of the Trapped Radiation Environment Volume VI: High Energy Protons (NASA SP-3024)

By JAMES P. LAVINE AND JAMES I. VETTE

This report is the sixth in a series describing model environments of the charged particles trapped in the Earth's geomagnetic field. The preceding volumes gave model environments for (I) protons and electrons in the inner zone, (II) electrons in the inner and outer zones, (III) electrons at synchronous altitudes, (IV) low energy protons, and (V) medium energy protons (Vette, 1966; Vette et al., 1966 and 1967; King, 1967; and Lavine and Vette, 1969). *Paperbound.* 52 pp. Available from the National Technical Information Service, Springfield, Va. 22151, for $3.00.

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